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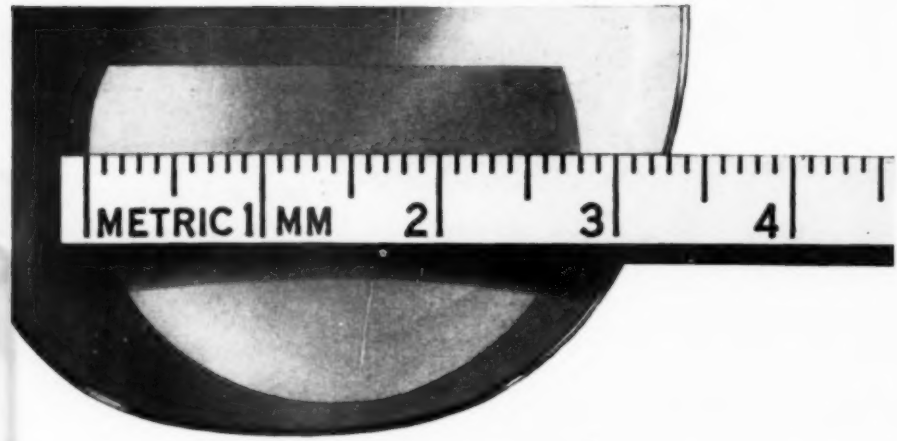

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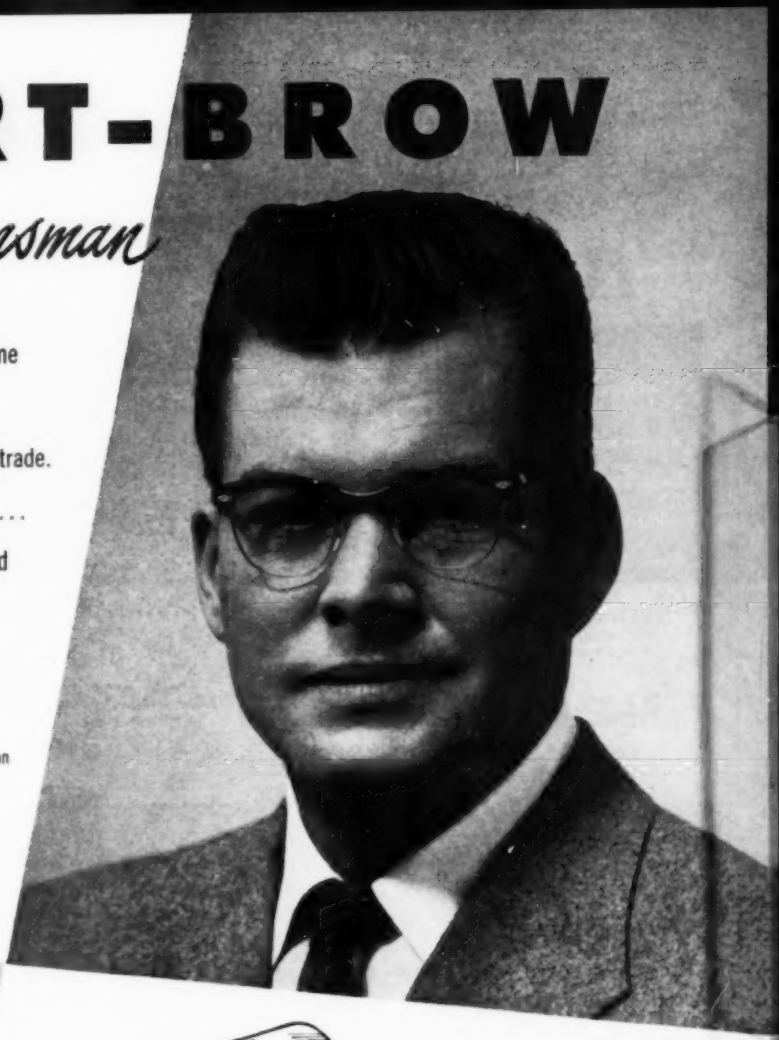

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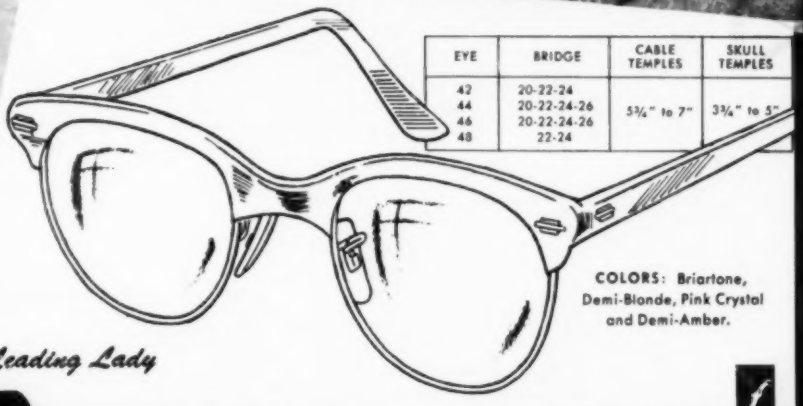

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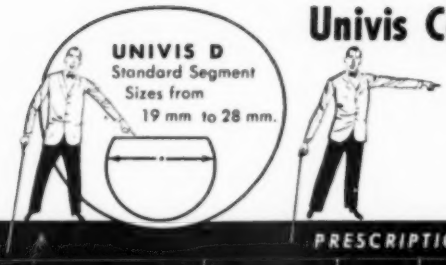

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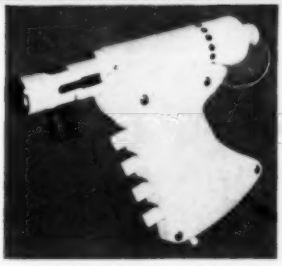

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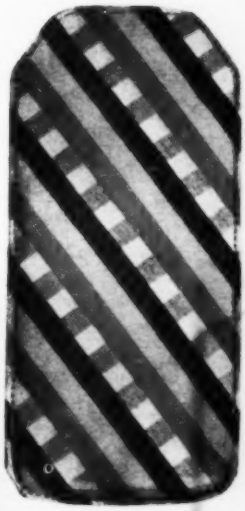

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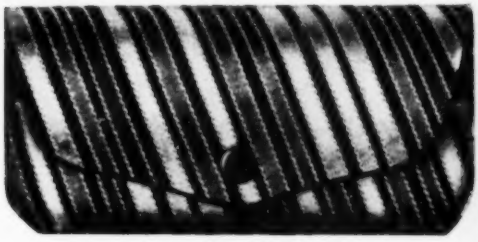

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Vol. 29 November, 1952 No. 11

DISTANCE VISUAL ACUITY TEST FOR SCHOOL SURVEYS*

Charles R. Stewart†
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Columbus, Ohio

INTRODUCTION

While the importance of distance acuity to the individual cannot be denied, the merits of using a distance visual acuity test as the sole indication of good or poor vision has been severely questioned. Since this obviously is more than should be expected of any single test, one should not be lead to the conclusion that the test is no good if it fails to achieve more than reasonably is to be expected of it. It is the purpose of this report to evaluate quantitatively the effectiveness of the distance visual acuity test in identifying school children who are in need of eye care.

In making this study, one has at least two possible approaches to the problem: (1) How effectively does the distance visual acuity test identify those pupils with clinically significant refractive errors? This approach is considered in Part I. (2) How effectively does the distance visual acuity test identify those pupils in need of eye care, irrespective of the source of the difficulty? This approach is considered in Part II.

The data selected for the present report were obtained from school survey records of two Catholic schools in Columbus, Ohio. These particular records were selected for several reasons. Since it was planned to use these records in other studies,[1, 2] extra care was taken in giving the tests and recording the results. The retinoscopic measurements were made by the author who, in the same manner, previously had measured the refractive errors of approximately 10,000 pupils. The other tests were given by senior students in the School of Optometry who previously had participated in at least four days of this type of work.

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†Optometrist. Ph.D., Member of faculty. American Optometric Foundation Research Fellow. Now, Dean, College of Optometry, University of Houston, Houston, Texas. Fellow, American Academy of Optometry.

Since experienced and semi-experienced examiners administered tests which are known to have a high degree of clinical validity, it is reasonable to assume that the results of the survey would correlate well with clinical findings.‡

Out of a total of 1,122 records, 963 were considered suitable for use. Records of pupils who customarily wore glasses were not used, and most of the unused records belonged to this group. A few records could not be used because they were incomplete, and a few others were not used because they could not be classified according to the criteria selected.

Because any test purporting to measure refractive errors would of necessity have to correlate well with retinoscopic measurements, and since most practitioners rely to a high degree on retinoscopic measurements when working with children, it was assumed for this study that the retinoscope finding represents the refractive error as it would have been measured clinically.

Although both principal meridians of both eyes were measured with the retinoscope, only one eye for each subject was used in analyzing the refractive data. The same eye also was used in analyzing the results of the visual acuity test. In the event that a difference between the two eyes existed, such that one eye was classified as normal and the other eye was classified as hyperopic, myopic or astigmatic,

---

‡During the retinoscopic measurements, pupils observed a movie cartoon through +3.00 D. working lenses which were mounted in standard P-3 Zyl frames. In order to relax accommodation, each pupil wore the plus lenses for several minutes while waiting his turn. The distance d, from the spectacle plane to the neutral point, was determined for both principal meridians of both eyes and converted to the dioptric equivalent D by means of the formula

$$D = 3.00 - \frac{1}{d}.$$

In practice, a string was calibrated directly in terms of D. Clinically, the author's retinoscope findings usually show approximately .25 to .50 D. more plus than is obtained with the subjective finding.

For the visual acuity test, regular clinical projectors and screens were used. Since all examiners had had clinical experience, no special instructions were given for administering this test. Regular Snellen notations were recorded for the right eye, the left eye and both eyes.

A 25 watt red light bulb placed at least 20 feet from the subject was used as the fixation point for the cover test. The subject was simply asked to "look at the red light" while the examiner covered one eye and then the other. The result of the test was recorded as esophoria, exophoria, esotropia, exotropia, or orthophoria.

For the corneal reflex test, the subject was asked to fixate a 7½ watt white bulb at 40 - 50 cm. The result was recorded as exotropia, esotropia or orthophoria.

Phoria measurements were made at 200 cm. and at 40 cm. by means of a modified Thorington test similar to that described by Hirsch.[6, 7] The subject saw a horizontal row of letters with one eye and a narrow vertical streak, produced by a small light source and a maddox rod, with the other eye. He was asked to read the letters aloud, stopping at the letter nearest the vertical streak. The separation of the letter from the light source was converted to prism diopters, giving the phoria

the latter eye was used. Anisometropia as such was given no consideration.

In conducting the survey program, it was noted that a large number of pupils, especially in the lower grades, could not or would not read the 20/20 letters when, according to the retinoscopic measurements and other tests, they should have been able to do so. If the visual acuity was subsequently rechecked, however, it usually came up to 20/20. The reason for this apparent improvement in visual acuity is not known, but it is assumed that the same sort of error is usually present in testing visual acuity of school children. In order to identify those pupils with true amblyopia, as well as to "keep the records straight," both the visual acuity and the retinoscope tests frequently were repeated. In this event the retinoscope test usually was found to be quite consistent from test to retest, while the visual acuity usually came up to normal.

Before considering the results of this investigation, one further point should be made: namely, that the efficiency of any test depends upon how the aims of the testing program are defined at the outset. If the sole aim is to identify those pupils with reduced distance acuity, then it may be assumed that the distance visual acuity test is a satisfactory criterion. If, however, one wishes also to determine the cause of the reduced acuity, then it is obvious that the distance acuity test will not do a satisfactory job.

PART I

For determining the efficiency with which the distance visual acuity test identified those pupils with refractive errors, the following criteria were selected:

1. *Hyperopia.* Since larger amounts of hyperopia are considered normal for younger pupils than for older pupils, 2.00 D. or over in at least one meridian of either eye was classified as hyperopic for grades 1 - 6, and 1.50 D. or over in at least one meridian of either eye was classified as hyperopic for grades 7 - 12.

2. *Myopia.* All those for whom the retinoscopic measurements indicated .25 D. or more of myopia in both meridians of either eye were classified as myopic.

3. *Astigmatism.* If the difference between the two principal meridians of either eye was 1.00 D. or greater, the subject was classified as astigmatic.

4. *Normal.* This classification includes all those pupils for whom neither eye was registered in any of the other three categories.

In general, each subject appears in only one refractive classification; however, a few subjects with astigmatism were registered in two.

If, for example, the retinoscopic finding was +2.00 D. in one meridian and +1.00 D. in the other, he was classified as having both astigmatism and hyperopia. If the astigmatism was 1.50 D. or more, he was classified only as astigmatic.

Throughout this study 20/20 was considered as passing for the visual acuity test, and 20/25 or less as failing.

As mentioned above, the visual acuity test was repeated if there was an indication that the first measurement was incorrect. In compiling Table I, however, the first measurement was used. This was done because it is the manner in which the acuity test ordinarily would be administered when used alone. The purpose of repeating the test was, of course, to obtain better correlation with the retinoscope test.

In Table I the columns labeled T show the total number in each category as indicated by the retinoscope test. Columns I indicate the number in each category which was identified by the visual acuity test. Columns E indicate the efficiency, E = I/T, of the distance acuity test in identifying those in each category. (i.e., E x 100 is the percentage of the total number in each category identified by means of the visual acuity test.)

Figure I is a plot of values of E by grade, and the dashed line shows the average value calculated from the totals in each category.

Considering a hyperope's ability to accommodate, Table I and Figure I-A indicate that the distance visual acuity test does as well or better in identifying hyperopes than should be expected. Since the numbers involved are small, no significance is attached to the fluctuations from grade to grade.

TABLE I.

EFFICIENCY OF DISTANCE VISUAL ACUITY TEST IN IDENTIFYING PUPILS WITH REFRACTIVE ERRORS

Grade	Hyperopia			Myopia			Astigmatism			Normal		
	T	I	E	T	I	E	T	I	E	T	I	E
1	9	4	.44	6	4	.67	11	9	.82	90	81	.90
2	3	0	.00	6	4	.67	6	5	.83	81	65	.80
3	2	1	.50	12	5	.42	3	3	1.00	65	60	.92
4	3	2	.67	12	7	.58	0	0	1.00	48	47	.98
5	3	1	.33	21	9	.43	7	7	1.00	57	52	.91
6	8	3	.37	17	9	.53	2	1	.50	42	39	.93
7	4	2	.50	16	4	.25	0	0	1.00	44	41	.93
8	3	1	.33	10	6	.60	3	3	1.00	58	56	.97
9	1	1	1.00	17	8	.47	6	5	.83	57	56	.98
10	4	2	.50	16	7	.44	3	2	.67	42	42	1.00
11	4	1	.25	24	14	.58	1	1	1.00	65	64	1.00
12	2	0	.00	16	6	.38	1	0	.00	53	52	.98
Total	46	18	.39	173	83	.48	43	36	.84	701	655	.934

T = Total number of pupils in category, as identified by retinoscope test
I = Number of pupils in category identified by visual acuity test
E = I/T = Efficiency of visual acuity test

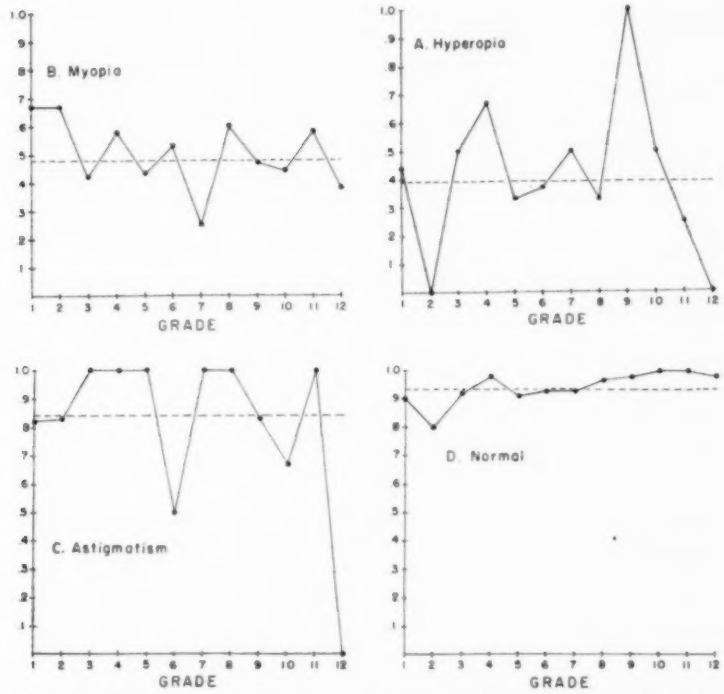

Figure 1. Efficiency of the distance visual acuity test in identifying pupils with (A) Hyperopia, (B) Myopia, (C) Astigmatism, (D) Normal refractive errors.

It often is assumed that the distance visual acuity test identifies all those pupils with any degree of myopia. Hirsch's data,[3] however, indicate that in myopes of a given degree there are considerable individual differences, such that a few myopes of 1.00 D. would be expected to read 20/20. If the pupil's best corrected visual acuity is 20/15, it is reasonable to believe that in most instances a blur of .25 D. or .50 D. would allow recognition of the 20/20 letters. But even if the visual acuity of these myopes is not reduced, perhaps some consideration should be given to them, since a high percentage in this group will probably need visual care at some time in the near future. If retinoscopic measurements are available, these pupils can be referred immediately for visual care, or can be given visual acuity tests at frequent intervals and referred when their acuity is reduced. If only

distance acuity is measured, however, the identity of these "myopes of tomorrow" is unknown.

Figure I-B shows the efficiency of the visual acuity test in identifying pupils with any degree of myopia.

Most of the myopes who were not identified by the visual acuity test were myopes of a low degree, since inspection of the original records indicated that the results of this study are in good agreement with Hirsch's data.[3] In other words, it appears that the distance visual acuity test very effectively identifies those pupils with 1.00 D. or more of myopia, but fails to identify a large proportion of those pupils with less than 1.00 D. of myopia. Most pupils with larger amounts of myopia were wearing glasses, and consequently do not appear in the analysis at all.

It is seen in Figure I-C that the distance acuity test does a relatively good job in identifying those with 1.00 D. or more of astigmatism. Nevertheless, 16 per cent of those with 1.00 D. or more of astigmatism were able to obtain 20/20 vision. It is well known among practitioners that less than 1.00 D. of astigmatism can cause rather severe visual discomfort, even though visual acuity is not appreciably reduced. On the other hand, many other persons have small amounts of astigmatism and apparently have no discomfort associated with it. In prescribing cylinders, rather than simply selecting some arbitrary value as has been done in this study, it is customary to consider the symptoms of eye strain, as well as the reduction of visual acuity. Because of the unreliability of symptoms reported by school children,[4, 5] however, perhaps an arbitrary selection is best for screening purposes.

Figure I-D shows that the distance visual acuity test also does a rather effective job in identifying those whose refractive error was classified as normal, especially in the upper four grades. The efficiency of this test appears to diminish somewhat in the lower grades, however. The increased efficiency in the first grade as compared to the second grade results from the fact that the illiterate E symbols were used in the first grade. Experience has since proved that the illiterate E symbols are to be preferred over regular Snellen letters for testing in both of these grades. There are a few pupils in the third, fourth and, occasionally, even in the fifth and sixth grades who can pass the illiterate E test but who pass the regular Snellen test only with considerable difficulty. The data in Figure I-D seem to substantiate the author's recommendation that the illiterate E test to be used in preference to regular Snellen letters at least through the second grade, and suggest the possibility of increased efficiency up as high as the fifth or sixth grade.

Inspection of the records used in this analysis indicates that the efficiency with which the visual acuity test identifies those with "normal" vision can be increased by running rechecks on all those who fail the test. If, however, this is done routinely on all who fail the test, one should be aware of the danger of decreasing its efficiency in identifying those with refractive errors. For example, a pupil with 1.00 D. or so of astigmatism may fail the test on his first trial, but get enough letters to pass on his second trial.

PART II

The second method of evaluating the efficiency of the distance visual acuity test is to use some means of identifying pupils who may be considered to be in need of eye care for any of several reasons, and to see how many of these "referrals" are identified by the visual acuity test. In this analysis, four different types of tests for identifying those in need of eye care were considered.

(1) *Retinoscope Test.* The criteria for failure were the same as those used for refractive errors in Part I. Any pupil classified in any of the refractive categories other than "normal" was considered a "referral."

(2) *Visual Acuity Test.* Only the first visual acuity measurement was considered in Part I. In Part II, the best visual acuity measurement was used. Any pupil who did not obtain 20/20 or better, O.D., O.S. and O.U., was considered a "referral."

(3) *Phoria Tests.* Phorias were measured at 200 cm. and at 40 cm. Those pupils with over 4Δ of exophoria or 4Δ of esophoria at 200 cm., and those with over 1Δ of esophoria or 9Δ of exophoria at 40 cm. were considered "referrals." Since the number of referrals involved in these tests is relatively small, both phoria measurements were considered in a single category. Phoria measurements were not made in the first grade.

(4) *Cover and Corneal Reflex Tests.* These tests were used primarily for the detection of squint, although the cover test also indicates distance phorias of a fairly high degree. Pupils registered as squinters by either test or as having exophoria or esophoria by the cover test were considered "referrals."

On the basis of these tests, a total of 351 "referrals" was found. Actually, not all of the 351 pupils were referred. Consideration was given to such things as previous eye care, or the relation of one test to another. From a practical standpoint, 2Δ of esophoria at near probably should not in itself constitute basis for referral. It was chosen for this study because clinically it is common to give more consideration to a small esophoria at near than to a small exophoria.

Table II indicates the test or tests which identified each of the 351 "referrals."

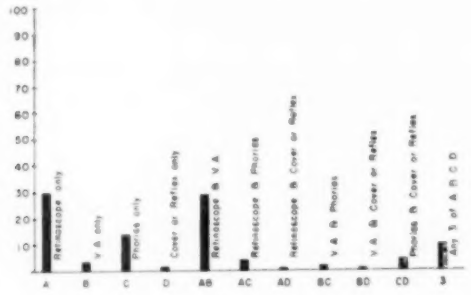

Figure II. Analysis of "Referrals."

Figure II is a graphical representation of the totals from Table II. From these totals the relative contribution of each test alone and each combination of tests can be seen. It should be noted that 51 per cent of the referral group were identified by two or more tests, and 10 per cent by three or more tests. This suggests the possibility of identifying all or nearly all of the referrals without using all of the tests.

Figure III shows the percentage of the 351 referrals which would have been identified if only the test or tests indicated had been given.

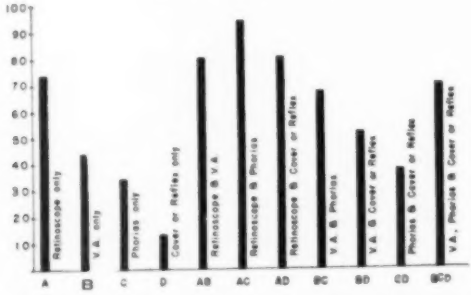

Figure III. Per cent of total number of "referrals" which would have been identified if only test or tests indicated had been given.

For example, column B of Figure III was obtained by adding columns B, AB, BC and BD of Figure II, plus those in column 3 who failed the visual acuity test.

TABLE II.
ANALYSIS OF "REFERRALS"

Grade	A	B	C	D	AB	AC	AD	BC	BD	CD	Any 3
1	6	0	—	1	15	—	1	—	1	—	1
2	6	0	3	1	7	0	0	0	0	4	4
3	7	1	4	1	2	3	0	2	0	2	3
4	4	0	4	0	5	2	1	1	0	1	4
5	11	1	3	1	11	1	1	2	1	2	5
6	11	0	2	0	12	3	1	0	0	1	2
7	10	1	4	0	4	3	0	0	0	0	2
8	4	2	4	2	9	0	0	1	0	3	1
9	10	3	3	0	11	1	0	0	0	1	2
10	12	2	9	0	10	0	0	1	1	1	3
11	12	0	10	0	13	0	0	0	0	0	4
12	12	2	3	0	3	1	0	0	0	0	4
Total	105	12	49	6	102	14	3	7	3	15	35

A—Identified by retinoscope test, passed all other tests.
B—Identified by visual acuity test, passed all other tests.
C—Identified by phoria test, passed all other tests.
D—Identified by cover or corneal reflex test, passed all other tests.
AB—Identified by both retinoscope and visual acuity.
AC—Identified by both retinoscope and phoria.
AD—Identified by both retinoscope and cover or corneal reflex.
BC—Identified by both visual acuity and phoria.
BD—Identified by both visual acuity and cover or corneal reflex.
CD—Identified by both phoria and cover or corneal reflex.
Any 3—Identified by 3 or more of A B C D.

As a single test, the visual acuity test appears to be a good one, since when used alone it identifies nearly half of the total number of "referrals." At the same time, however, one must recognize its limitations. It should not be expected to do as well as the retinoscope test in identifying those with refractive errors, or as well as the phoria tests in identifying those with muscular imbalance. It is obvious from Figure III that, if one wishes to identify more than 70 per cent of those classified as "referrals," the retinoscope test must be included in the testing procedure.

SUMMARY

The results of this investigation are summarized in Figures I, II and III.

Using the criteria described in the context, it was found that in a group of approximately 1,000 school children the distance visual acuity test correctly identified 39 per cent of those with hyperopia, 48 per cent of those with myopia, 84 per cent of those with astigmatism, and 93 per cent of those with "normal" refractive errors.

Using the visual acuity test as a single test for determining those pupils who are in need of eye care for one or more of several reasons, 44 per cent were identified. This is significantly more effective than any other single test used, with the exception of the retinoscope test.

In closing, it should be pointed out that frequently it is difficult to elicit maximum acuity with standard Snellen letters, especially among pupils in the lower grades. The author has suggested that the Illiterate E be used through at least the first and second grades.

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ABSTRACTS

A FACTOR OF DEPTH PERCEPTION TEST SCORES OF MALE SUBJECTS HAVING NORMAL ACUITY. Howard C. Olson. North Carolina State Optometric Society Research in Vision Project, Department of Psychology, North Carolina State College, Raleigh, N. C. pp. 9-19, 1952.

Since previous studies have indicated that visual acuity influences the variance of depth perception stereopsis tests, this study was concerned with stereopsis test differences when acuity is held constant. The subjects were 70 male college students, ages 19 to 33 years, who had visual acuities of 20/20 or better in each eye. Eleven tests of binocular depth perception were administered on a test-retest basis. Visual skills including near and far acuity, near and far vertical and horizontal phoria were taken at the time of the retest by the B & I. Ortho-Rater. As a result of factor analysis it is concluded "that one *consistency of depth judgment* on a test of real depth is the most reliable and valid measure of depth perception."

ROBERT E. BANNON.

THE CAUSES OF ERRORS OF REFRACTION. H. Hartridge. The British Journal of Physiological Optics. New Series, 7, 3, 143-149, 1950.

The author discusses the part axial length of the eye plays in determining the total refractive power of the eye. He relates this factor to that of the radius of the cornea and the accommodative status, as well as to the index of the media, and shows how these independent variables can alter the refractive status when associated with one another in a random manner. He also discusses refractive changes due to pathology and hereditary causes.

CAREL C. KOCH.

A STUDY IN CONSENSUAL ACCOMMODATION*

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INTRODUCTION

Innumerable investigations have been made to determine the true nature of accommodation and its mechanism. The theories of Helmholtz and Tscherning agree that the crystalline lens is acted upon by the ciliary muscle to obtain a clear focus in near vision. The autonomic nervous system governs the action of the ciliary body which is composed of smooth muscle fibers. Hence, the activity of accommodation is normally not subject to voluntary control and for the most part is subcortical in nature.[1] A psychic demand to see clearly must, however, be present as accommodation is not entirely automatic. The impulses which eventually cause change in the crystalline lens must first originate in the cortical center. The ability of an individual to accommodate for near may be affected by injury or pathology so as to disrupt the normal functioning of the two eyes. The individual may demonstrate that he is capable of accommodating more or less with one eye than the other. A post-war study of Horner's syndrome in soldiers revealed that the near point was from one to four centimeters closer on the affected side than on the normal side. In a series of five patients, Cogan[2] found an increased capacity to accommodate of the affected side varying from 0.50 D. to 2.5 D. after surgical or other damage to the cervical portion of the sympathetic nervous system. This would lead one to believe that unequal accommodation was present: a condition which could ensue if the innervation were interfered with in either eye due to pathology or trauma. Inequality may occur in ophthalmoplegia interior due to syphilis, tabes, traumatism, or toxins as these conditions may affect one eye more than the other. In these cases the sphincter irides

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†Graduate student.

and the ciliary muscle are usually affected simultaneously, hence the inequality in accommodation is generally associated with inequality of the pupils. Unequal accommodation may be caused by unequal action of the ciliary muscles. This was evidently the cause when a subject manifested an amplitude of accommodation of the right eye which varied from three to four diopters and of the left eye a variance of five to six diopters.[3] The patient showed marked fatigue of accommodation in the right eye. The cause was obscure, but intestinal toxemia and dental infection were present. The symptoms included intense asthenopia and a marked spasmodic convergence when he tried to use his eyes for near work. Most of the cases of this sort seem to be due to an unequal rigidity of the lenses in the two eyes. In other words, it is a form of presbyopia in which the sclerotic changes of the lens have advanced faster in one eye than in the other. Like simple premature presbyopia, it is probably a mere physiologic peculiarity producing no symptoms until the accommodation of one eye decreases to the point where the addition of a convex lens for near work is required. This condition of unequal presbyopia or non-pathologic inequality of the accommodative response is found mainly in patients between the ages of 35 and 50.[3] Hence, unequal focus may be due to the ciliary muscle or the crystalline lens may be more rigid in one eye than in the other.

Pathological, physiological, and neurological anomalies may result in the ability of an individual to accommodate unequally, yet among the investigators there is considerable controversy regarding the ability of a normal observer to duplicate the performance. Fick[4] believed he was able to read small print with both eyes even when a concave or convex lens of 1 D. was placed in front of one eye. The evidence brought forth by Hess and Neumann[5] is contradictory for they found that in the normal individual it is possible to compensate for a difference in refraction between the two eyes of only one-eighth of a diopter. According to Donders the amount of accommodation in anisometropia is the same in the two eyes, and the accommodation will be more exact in the eye in which the sharpest and largest images are formed with the smallest demand upon accommodation. Yet it has been stated by Emsley[6] and Zoethout[4] that unequal accommodation for the two eyes is expected in anisometropia. In 1933 Grimm[7] reported the results of duplicating Hess' experiment to determine the possibility of unequal binocular accommodation. Hess denied its existence, but Grimm believes that he is capable of compensating, by an unequal accommodation, for a difference in refraction of about 1 D. In this experiment a needle was placed 1 cm. in front of the small target used for fixation. The clarity

of the crossed images of the needle was then determined with a 1 D. lens in front of one eye. With each test the initial impression seemed to confirm Hess' result, but an attentive fixation quickly showed the equality of clearness, which persisted. Years later Stoddard and Morgan[6] attempted an experiment on monocular accommodation, publishing their results in 1942. They concluded that monocular accommodation occurs in various subjects when a monocular accommodative stimulus is presented to eyes performing a binocular visual task. The amount of monocular accommodation varies roughly with the magnitude of the accommodative stimulus presented and for a given subject. In general, the maximum amount of monocular accommodation for any monocular accommodative stimulus rarely exceeds one-half diopter. On an average, it has an approximate value of one-eighth diopter for all monocular accommodative stimuli between plus and minus one-quarter diopter and plus and minus one diopter.

In pathological conditions it is undoubtedly true that the affectation results in an abnormal response, however, the present study centers about the discrepancy which exists in the literature regarding the ability of the normal individual to stimulate the accommodation in one eye independently of the other eye. According to Hering's law of equal innervation, the innervation to the muscles of one eye is equal to that sent to the other eye. It is generally assumed that innervation to accommodation is bilateral, and that any change in the ocular refractive state in the interest of clear binocular vision occurs to the same degree in each eye.[8]

Impulses from the cortex influence the single, medially located Nucleus of Perlia which is the center for control of the ciliary muscles. Because of the medial situation of the accommodative center in the mid-brain, accommodative innervation is always bilateral.[4] Thus the innervation to each eye can reasonably be expected to be equal in amount. But equal innervation does not necessarily mean equal response. However, Duke Elder[5] states that all the evidence tends to indicate that if any of the ciliary muscle contracts in a living human, it contracts equally all around, and if the muscle of one eye contracts the muscle in the other eye acts equally and simultaneously in all ordinary conditions.

An investigation of the literature reveals a dearth of information regarding this problem of unequal accommodation. Since studies in various binocular visual phenomena lead one to believe that under certain visual conditions accommodation might not be equally represented in each eye, it seems desirable to investigate further the possibility of consensual accommodation on a quantitative basis.

OBSERVERS

Ten observers were selected at random from the student body at the Chicago College of Optometry. Biased selection was eliminated by having the clinic director send the first 10 male clinicians to report for duty to the research department. Since all subjects were less than 35 years of age lenticular changes associated with presbyopia and premature sclerosis were absent. Each observer had single binocular vision with an unaided or corrected minimum visual acuity of 20/20 with no significant anisometropia and no known ocular or general pathology. A near point of accommodation which was approximately equal for the two eyes was necessary for participation in this study.

APPARATUS

This study was conducted under photopic conditions with the same brightness standardized for all observers. Since this investigation was divided into objective and subjective parts, two different forms of apparatus were utilized. In the objective part of the experiment the right and left visual fields of the observer were separated by a homogeneous grey septum. A fine focus target consisting of two parallel lines divided by a space equal approximately to their width, and based on the visual threshold for the minimum separable was used because of its high retinal resolution value. To eliminate gloss a Strathmore illustration board with a matte surface was used as background for the parallel lines which were constructed by using black India ink with a low gloss ratio. The surrounds consisted of a homogeneous grey, nasal septum, and a similar movable uniform grey field which was placed parallel to the fine focus target but farther from the observer. (See objective apparatus, Figures 1 and 2). This arrangement eliminated extraneous visual stimuli as well as glare, since anything in the surround that is brighter than the target is glare.[9] Studies made by Pascal[10] in the measurement of accommodation and convergence show that a target consisting of two, slightly-separated, short lines is reliable. Schoen[9] also found this target to be reliable in his investigations, and personally recommended its use in this study.

The observer fixated this fine focus target at a distance of 16 inches while a streak retinoscope was utilized to determine the refractive condition in the horizontal meridian. The brightness of the streak was reduced, by means of a rheostat, to a level just bright enough to make it possible to neutralize the visable motion of the reflex by the use of corrected curve trial case lenses.

Retinoscopy was elected as a standard for measurement as many investigators have found it to be reliable. Pascal[10] states that the power

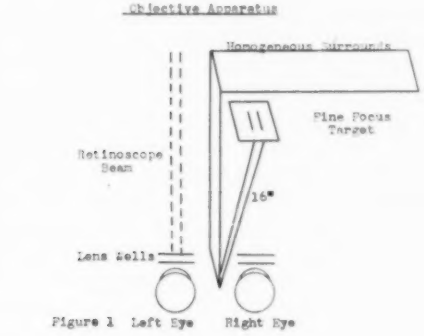

Figure 1

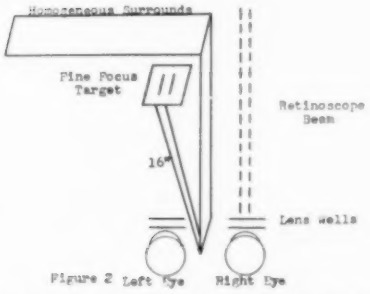

Figure 2

of accommodation can be determined objectively by means of retinoscopy, and that this method is especially suitable for determining equality or inequality of accommodation in the two eyes. In addition, Kurtz[11] concluded as a result of work with several tests on 26 observers that the least variable results are obtained by using the objective dynamic retinoscopic test. Saks[12] believes that dynamic skiametry provides the most accurate measure of accommodation. Fearn[13] writes that the reliability of a retinoscope shows a variation of one-eighth of a diopter. The consensus of these investigators seems to favor the procedure outlined to measure the refractive change objectively and that this change in accommodation can be recognized was determined by Morgan[14] who says, "Dynamic skiametry is a measure of response." Hence, it follows that if an accommodative response is made to a lens, it can be measured.

The effect of concave and convex spheres on accommodation was carefully considered. Fearn[13] states that a small change in lens power, near the middle of the accommodative range, causes an almost equal

change in accommodation. Schoen[9] claims that the accommodative response is equal to the accommodative stimulus using concave spheres but that the accommodative response may be less than the accommodative inhibition using convex spheres. Morgan[15] using a constant fixation target and varying accommodation by the use of lenses found a direct one to one relation existing between the stimulus and the response. For this reason concave spheres were used for the stimulus to accommodation in this study.

In the subjective part of the experiment the observer directed his visual axes straight ahead so that each axis was intercepted by one of two adjustable plane mirrors placed at approximately a 90 degree angle. The visual fields of the right and left eyes were separated by reflection. Two fine focus targets each consisting of two parallel lines, as described in the objective apparatus, were placed one on each side of the observer's head (one pair of lines horizontal and the other vertical) so that he projected a cross directly in front. A diagram of this arrangement can

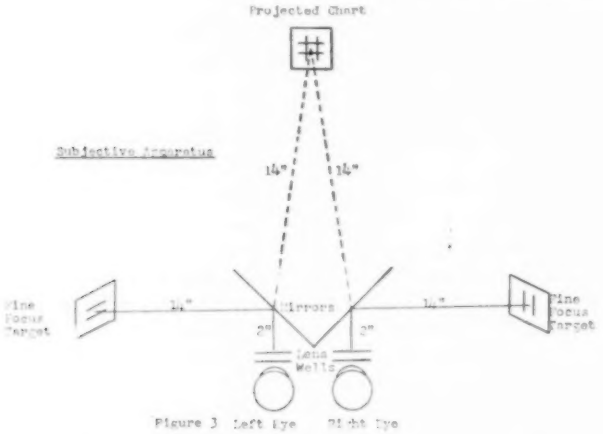

Figure 3 Left Eye Right Eye

be seen in subjective apparatus, Figure 3. Concave lenses were added to modify the accommodative state. Here again the brightness must be sufficient to permit easy discrimination of figure and ground, as well as to eliminate the possibility of lack of accommodation. Wald and Griffin[16] claim that in dim light the eye fails to accommodate, resembling an eye paralyzed with homatropine. Once the brightness is increased to permit accommodation to operate in response to a target stimulus, any further increase in brightness does not cause an accommodative

increase. An apparent increase in acuity results without a corresponding increase in refractive power of the eye.[12]

The objective and subjective determinations of consensual accommodation differ not only in the role which the observer plays, but also in the manner in which unequal accommodation is being elicited. In the former method one eye fixates the test chart and is stimulated by a concave lens while the retinoscopic change is noted in the other eye; while in the latter method both eyes fixate similar test charts while a monocular stimulus to accommodation is presented in an attempt to force an inequality in accommodation through the use of concave lenses.

PROCEDURE

Prior to the basic accommodative studies a careful history of pertinent factors was obtained from each observer consisting of name, date, age, pupillary distance, dominant eye, and refractive error. The unfused cross cylinder finding was determined after the distance vision had been corrected with special attention to astigmatism. The responses were critically evaluated after which the observer was directed to fixate the two, vertical, parallel lines at 16 inches through the optimum power for best visual discrimination at that distance. The uniform grey surrounds were put in place and the observer fixated the fine focus target monocularly. He was instructed to think of nothing else, to concentrate, and to maintain his attention on the parallel lines attempting to keep them clear and separate. At this time the non-fixating eye was scoped and neutral obtained in accordance with psycho-physical methods of measurement. This was accomplished by scoping in both directions, that is, until the first recognizable against motion in one direction and the first recognizable with motion in the other direction was identified. The results were averaged to obtain the true neutral. The first of the series of minus lenses was added before the fixating eye, and without exception the observer noted the difference in clarity and refocused immediately. The non-fixating eye was neutralized again as before to obtain the consensual change in accommodation. This procedure was repeated for successive stimulations, and then the fixating eye became the non-fixating eye in the following series of studies. With each addition of minus sphere to the fixating eye the observer was asked how many lines he saw and if they were as clear as before. This was very important as the average subject accommodates as little as possible when fixating a near target.[17] As long as the response was positive, the non-fixating eye was scoped again to note the consensual accommodative change.

Following a brief rest period the observer was permitted to view the subjective apparatus. Adjustment of the mirrors caused the horizontal and vertical parallel lines to form a cross. The exact projection in space depends upon the observer's position of rest for that fixation distance (16 inches) and the amount of accommodation in use at that time. With the proper lenses in front of each eye as determined in the objective part of this investigation, minus spheres were added monocularly until one target blurred, or formed a single straight line, meaning accommodation did not make a sufficient response. The observer was instructed at all times to keep the parallel lines as clear as possible. After the insertion of a concave lens he was asked to report any change in the appearance of either the horizontal or vertical parallel lines. Hence, instructions were simple enough to elicit a simple judgment. Here again the psycho-physical principal was applied by gradually adding stimulatory lenses until the observer first reported a blur or a single line, and then reducing concave spheres until no difference was manifest in the targets. An average was obtained and recorded as the finding, or the magnitude of concave sphere the observer was able to tolerate by accommodating unequally.

After adequate instruction the investigation proceeded without delay because on the average, the change in accommodation from near to far requires 0.426 seconds (with instructions to react quickly), and 0.505 seconds from far to near.[18] The figures cited vary with the size of the target. Results indicate the average accommodation time for the left eye is approximately equal to that for the right eye (.322 seconds). There was no difference in far to near and near to far accommodation for one meter and four meter distances.[19]

The observer's ability to maintain accommodation throughout this study without showing a decrement in performance is beyond question, as 69 per cent of the investigations in ocular fatigue show no evidence of accommodative fatigue. However, general fatigue becomes a factor after 15 minutes.[20] Therefore brief rest periods were provided every quarter of an hour.

RESULTS

The results of this investigation are presented in two sections to logically follow the procedure which dealt with objective and subjective methods of testing. In the objective part of the study a monocular accommodative stimulus was introduced before the fixating eye which performed a fine focus task on the target. The non-fixating eye, directed to a homogeneous field, was scoped to determine the magnitude of the consensual accommodation. The test results showed that equal accom-

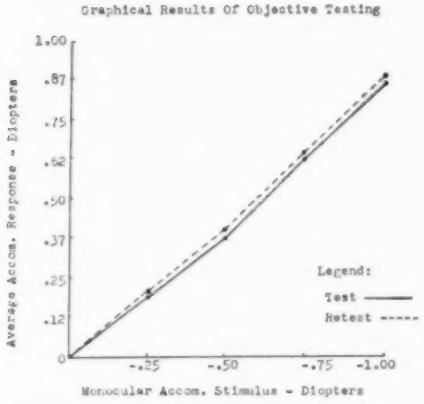

Figure 4 Right Eye Fixating

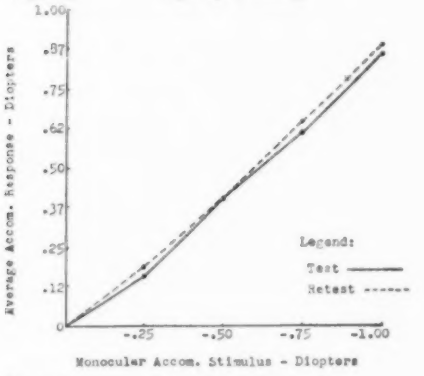

Figure 5 Left Eye Fixating

modation was not present, and that a measurable accommodative difference existed. The average accommodative difference for each stimulatory step has been calculated and presented in Table I. Here it can be observed that in general as the magnitude of the accommodative stimulus is increased the amount of accommodative difference increases. The per cent of consensual accommodation is also tabulated and graphically shown in Figures 6 and 7. The high correlation between test and retest is evident.

In Table II the consensual responses are represented by the mean, sigma, and standard error of the mean corresponding to the stimulating

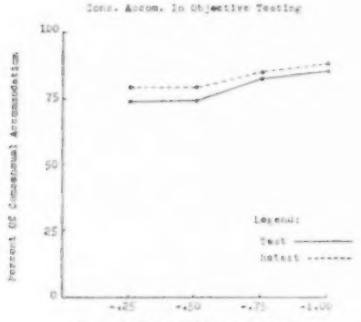

Figure 6

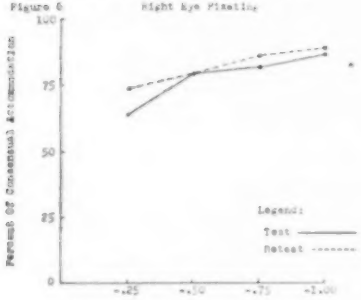

Figure 7 Left Eye Fixating

concave sphere. The reliability of the means is shown by the low sigma of the means. The relationship between the monocular accommodative stimulus and the average accommodative response is graphically shown in Figures 4 and 5. In these graphs the ordinates indicate the average accommodative response for the observers, and the abscissae indicate the monocular accommodative stimulus for each eye in diopters. A comparison of the test and retest is presented for the right eye fixating and the left eye fixating. The close proximity of the lines indicates a high correlation. The actual correlation was worked out by the product-moment method, first for the right eye fixating and then for the left eye fixating. The former value was found to be .976 while the latter was equal to .967 using test versus retest. The reliability of the instrumentation had definitely been established as a coefficient of .403 would be needed for a significant correlation at the one per cent level. The values found greatly exceeded this figure.

RESULTS OF OBJECTIVE TESTING

TABLE I

Amount of Consensual Accommodation and Accommodative Difference

Accom. Stim. Right Eye	Cons. Accom.	Test Accom. Diff.	% Cons. Accom.	Cons. Accom.	Retest Accom. Diff.	% Cons. Accom.
Right Eye Stimulated						
.25	.185	.065	74	.198	.052	79.2
.50	.373	.127	74.6	.396	.104	79.2
.75	.623	.127	83	.646	.104	86.1
1.00	.861	.139	86.1	.884	.116	88.4
Left Eye Stimulated						
.25	.159	.091	63.6	.185	.065	74
.50	.398	.102	79.6	.396	.104	79.2
.75	.610	.140	81.3	.647	.103	86.3
1.00	.860	.140	86	.884	.116	88.4

RESULTS OF OBJECTIVE TESTING

TABLE II

TEST - RETEST

Stim. Lens	Mean Cons. Accom.	Test Sigma	Error of Mean	Mean Cons. Accom.	Retest Sigma	Error of Mean
Right Eye Stimulated						
—.25	.185	.065	.022	.198	.063	.021
—.50	.373	.096	.032	.396	.052	.017
—.75	.623	.096	.032	.646	.052	.017
—1.00	.861	.103	.034	.884	.068	.023
Left Eye Stimulated						
—.25	.159	.059	.020	.185	.065	.022
—.50	.398	.094	.031	.396	.054	.018
—.75	.610	.110	.037	.647	.076	.025
—1.00	.860	.120	.040	.884	.068	.023

By inspection it can be seen that there is no significant difference between right eye and left eye, and between dominant eye and non-dominant eye. With the right eye fixating the average accommodative difference equalled .115 for the test results, and .094 for the retest results. With the left eye fixating the average accommodative difference equalled .118 for the test results, and .097 for the retest results. These data show that at a given period the consensual accommodation is

unaffected by the fixating eye, yet varies in observers from day to day. On an average the accommodative difference between the two eyes of a normal observer has a value of .106 diopters for all monocular accommodative stimuli between —.25 and —1.00 diopter. The accommodative difference and the per cent of consensual accommodation for each stimulatory level can be found in Table I.

In the subjective part of the study, the observer maintained binocular fixation while a monocular accommodative stimulus was introduced, and an attempt was made to overcome the induced stimulus to accommodation by an unequal response. The results showed that the observers were capable of unequal accommodation only to a limited extent. In Table III the unequal responses are represented by the mean, sigma, and standard error of the mean for the test and retest with the right and left eye stimulated respectively. The low values for the sigma of the means establishes the reliability of the means.

RESULTS OF SUBJECTIVE TESTING

TABLE III

Amount of Differential Accommodation

	Right Eye Stimulated			
	Mean Accom. Diff.	Sigma	Error of Mean	Range
Test	.222	.097	.032	.12 - .37
Retest	.235	.087	.029	.12 - .37
	Left Eye Stimulated			
	Mean Accom. Diff.	Sigma	Error of Mean	Range
Test	.209	.098	.033	.12 - .37
Retest	.185	.065	.022	.12 - .25

A critical ratio was calculated for the test and retest first when the right eye focused through the additional concave lens, and then when the left eye focused through the additional concave lens. In the former case the critical ratio was .464, and in the latter case the critical ratio was .686. A "t" value of 3.25 or above is needed to show a significant difference between the means at the one per cent level of confidence. The values herein presented fall far below this level of significance showing the reliability of this technique.

The average of .216 D. for the test values for unequal accommodation compares favorably with the .210 D. average for the retest values. The ability of an observer to vary in his consensual accommodation from day to day can be observed in these data. But on an average the test results show that a normal observer can accommodate unequally .213 D. while maintaining binocular fixation. The difference

found in the average for the objective part of this study as compared to the subjective part of this study can probably be attributed to the psychological factors which enter into the observer's interpretation. Furthermore, in the subjective part the observers were forced to accommodate unequally in order to see the two targets clearly, while in the objective part the consensual response was produced by a monocular stimulus to accommodation while the stimulated eye was engaged in a fine focus task. Under these conditions it would be expected that the amount of unequal accommodation would be greater in the subjective part. The results previously presented show this statement to be true.

CONCLUSIONS

The results of this investigation permit three main conclusions:

1. The tests for the reliability showed the instrumentation to be satisfactory for both parts of the experiment.

2. Under the conditions of the experiment it was demonstrated that the consensual accommodation was not equal to that of the stimulated eye, and that a normal observer was capable of accommodating unequally to a limited degree.

3. The magnitude of unequal accommodation agrees essentially with prior investigations in spite of the fact that two different methods were utilized to obtain the results. The sensitive targets elicited a more refined response resulting in a more accurate measurement of unequal accommodation.

As a result of this study in consensual accommodation several problems are indicated which require scientific investigation. First, the possibility of unequal accommodation in anisometropia and its magnitude if present. Second, the determination of the accommodative inequality in the two eyes at different levels of accommodation, or for varying distances of the target. Third, a measurement of the existing accommodative relationship in a group of observers, followed by an attempt to train unequal accommodation by simultaneous stimulation of one eye with inhibition of the other eye, and a subsequent measurement to determine if there is any significant change in the focus ability of the two eyes.

SUMMARY

The results of this study may be summarized as follows:

1. The studies of Hess and Neumann, and Stoddard and Morgan show the average for unequal accommodation to be about .12 D.

2. Ten observers from the clinic at the Chicago College of Optometry were utilized in this investigation.

3. The study was divided into two parts so that measurements

could be taken both objectively and subjectively.

4. Psycho-physical methods of testing were employed to obtain the most reliable results.

5. In the objective part of the experiment the average unequal accommodation was .106 D, while in the subjective part of the study it was found to be .213 D.

6. The instrumentation proved to be reliable, and the results agree with those of other investigators using different methods.

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THE OBJECTIVE DETERMINATION OF VISUAL ACUITY ON THE BASIS OF THE OPTOKINETIC NYSTAGMUS*

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In the late Summer of 1951, the German magazine, *Der Augenoptiker*, carried a lecture delivered by the late Dr. Pistor[1] on the subject of optokinetic nystagmus and its method of determining the resolving power of the human eye. As my own knowledge and that of colleagues and ophthalmologists whom I consulted was limited on this problem, I decided to obtain further information on the subject. An inducement to familiarize myself with the intricacies of the optokinetic nystagmus was to be able to determine objectively the patient's visual acuity. Every optometrist has had the desire to determine the resolving power of the eye without relying on the answers of the patient, as we have all had doubt as to the exactness of the patient's answers.

We understand that under the usual visual acuity measuring system the reciprocal value of the angle under which a letter is seen is the unit. We use the smallest angle under which an eye is still able to see two separate points as two points, which is normally a one minute angle of an arc. The smaller the angle under which the two points are seen, the higher the visual acuity or angular resolving power, often referred to as *minimum separabile*.

It is important that the optometrist think not only in terms of Snellen fractions, but also in terms of the visual angle. It is easy to see that a visual acuity of 20/20 represents an angle of one minute of an arc, and 20/50 an angle of 2.5 minutes of an arc, etc. While we refract here at a distance of 20 feet or 6 meters, the international optotypes are based on a 5 meters distance, introduced by Carl von Hess. The Snellen optotypes must be recognized in their entirety and Hess termed the reading value the *minimum legibile*; therefore actually the Landolt rings are the only ones based on the *minimum separabile*. The examination distance of 5 meters has as its advantage that the visual acuity can be expressed in tenths instead of the fractions used in the United States. The angular resolving power of one minute of an arc is referred to as Visus - 1.[2]

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If we move an object in the field of vision, the eyes will follow it almost unconsciously, thereby making certain movements. These movements are easily seen when a person looks at the passing scenery out of a window of a moving train. While the eye fixates a point of regard it follows the object smoothly. As soon as it is out of the field of vision the eyes move back quickly with a jerk to another point of fixation. This type of nystagmus is known as "railroad" nystagmus, and it is of physiological nature. It is also known as optokinetic nystagmus. The movements of the eye following a point of fixation are of a voluntary and slow nature, called the long phase of the nystagmus, while the rapid jerk back is an involuntary movement, the rapid phase of the nystagmus.

Purkinje, Helmholtz, Hering and others were familiar with this type of nystagmus but it fell to the Swedish ear specialist, Barany, who, in 1907, was the first to investigate it clinically and experimentally. By using hot or cold water in rinsing the ears he noted in patients certain jerky eye movements. Through his writings, ophthalmologists and neurologists became interested in the subject, but not for long. Again it was Barany who, in 1920, reported on the *optischen nystagmus*, as he called it, and in this paper he laid down his classical theory. The word classical was given to this work by Dr. Johannes Ohm,[3] who did much more experimental work in this field. According to Barany,[3] the impulses which are necessary to create the optokinetic nystagmus are, (1) The fixation impulse. (2) The impulse to follow the moving object. (3) The rapid jerk back to view the next object to be fixated.

This theory has the most adherents today. Later the three innervations were combined into two, the *Fuehrungs*, or leading, and the *Einstellungs*, or fixation movement. In 1922, Ohm proposed the oscillation theory, which says that an optically sensitized movement in one direction creates oscillations, which show themselves in the eyes as jerk nystagmus. Barany and his followers believe in the cortical reflex pathway of the optokinetic nystagmus, while Ohms, Bartels, *et al*, believe it to be of subcortical nature. Guenther in his work states that in today's opinion, both views are possible.

In the field of optokinetic nystagmus Ohm assumes a unique role and his writings for the last 45 years assume a work of gigantic proportion. In a letter to the writer, Ohm feels that his scientific studies did not get the credit they deserved. It is my belief that Ohm became interested in the problem in working with Miners' nystagmus, as he practices in the heart of the Ruhr.

In optokinetic nystagmus the movements may be horizontal,

vertical or diagonal but they are never of a rotary type. Adler[4] in his book, *"Clinical Physiology of the Eye,"* divides nystagmus after Fox in the following classifications:

1. Nystagmus of vestibular origin. (a) Physiologic. (b) Pathologic.
2. Nystagmus of optic origin. (a) Physiologic (optico-kinetic). (b) Pathologic (Miners Nystagmus, etc.). (c) Due to impaired vision (Congenital).
3. Nystagmus of neuromuscular origin.
4. Nystagmus of cerebellar origin.
5. Nystagmus of uncertain origin.

This report deals only with optokinetic nystagmus. To create this type of nystagmus experimentally various techniques were employed.

1. Through rapid rotation of a person on a revolving chair and placing a rotating cylinder over the head of the person, the whole visual field will be sensitized.

2. Through sensitization of a central visual field using a rotating drum with vertical stripes, viewed from a certain distance. Some examiners used both horizontal and vertical stripes.

3. Through sensitization of a central visual field which becomes enlarged by moving an area of stripes through the frontal plane horizontally.

4. Through sensitization of the peripheral field with the point of fixation serving as the center of a rotating disc.

5. By creating pendulum-like eye movements with a moving pendulum.

In the above mentioned experiments the horizontal movements of the test objects were preferred. Black and white stripes of certain sizes, (which in some cases could be varied from 0.25 cm. to 10 cm.) served mostly as test objects. Further complicated figures, letters, colored pictures and dots as well as pinheads and chessboard fixation objects[5] found their use. The test distances vary somewhat but are seldom over one meter. The speed of the test objects following each other were expressed through the rotation of the instrument.

To create a slow, smooth, sliding movement of the eyes it is necessary to use a movable object of regard, and the maximum speed under which the object can be seen is one to five degrees per second. If the object moves faster the eye movements become saccadic. This movement is the slow or the long phase of the nystagmus. When our attention is called to a point seen with the periphery of the retina, our desire to see it clearly will bring it to a focus on the fovea, and the eye movement is jerky. This is called the rapid phase of the nystagmus. On the nystagmogram we see decidedly the two phases, the slow one is in the direction of the movable object and the rapid phase in the opposite direction. The height of the movement is measured in milli-

meters and called the amplitude. The following oscillation or the number of the eye movements is the frequency of the optokinetic nystagmus. Ohm called the total of the amplitude times the frequency, the energy of the nystagmus. The amplitude depends on the size of the sensitized field while the frequency is a function of the speed of the movable objects of regard. This brings to our attention the fact that the larger the field of innervation, the larger the amplitude, and the easier the nystagmus is to be seen.

Paying attention to the test object on the part of the patient will result in a more visible nystagmus and of a larger amplitude. The illumination seems to have but little bearing on the result, although the adaptation of the patient has to be equal to the general or room illumination. The optokinetic nystagmus is a function of the whole retina, rods and cones. While the fovea will give a better visible result, nystagmus on the periphery will still be possible, as for instance in a case of foveal pathology.

The optokinetic nystagmus depends also on the speed of the movable object of regard. It is best expressed through the velocity formula of Cords

$$\frac{\text{Velocity}}{\text{sec.}} = \frac{\text{Length of band over the rollers}}{\text{Rotation time x Viewing distance}}$$

Although the nystagmus depends on this angular velocity, the most important point is the number of objects per second passing the point of fixation. This is the oscillation frequence expressed in Hertz.

$$\text{Hz} = \frac{\text{Angular velocity (Cords Formula)}}{\text{size of angle}} \times \text{number of innervating objects}$$

The better the visual acuity the better will be the optokinetic nystagmus. Still the nystagmus will be seen in rather low visual acuity. According to Guenther, this is true if the test is made by hand or finger movement at one-half meter in front of the patient, even if only light sense is still present.

There is a difference in the induction of the nystagmus in right and left movements of the object. The one to the left is easier to induce than the one to the right, and the nystagmus is stronger when the object is moved from left to right. Most observers today agree that the nystagmus in babies will be present with the time they have learned to fixate, otherwise age is no obstacle. Since it can be induced at an early age the determination of the visual acuity would be of prime importance in pre-school children, and in amblyopic or squint cases.

Hemmung or stoppage or the breaking off of the nystagmus occurs when the fixation wanders off the innervating object. It can also be caused by inattention or by refusal to accommodate on the sensitizing object. Particularly is the stoppage noticeable when a stationary object in the field of innervation is fixed. On this observation Ohm established his method to determine the visual acuity objectively, and he was the first to make use of it in 1931.

To induce the optokinetic nystagmus, Ohm, like Barany, used a turning drum. It had a diameter of 40 cm. and a height of 20 cm. On the drum were painted black and white stripes 3 cm. wide. The rotating time of the drum was 4 seconds. The patient was placed 50 cm. in front of the drum, and it was viewed under an angle of 33 degrees horizontally and 20 degrees vertically. In most of his experiments the drum was turned to the right to induce left jerks. Between the patient and the drum, Ohm placed a thin glass plate at an angle of 45 degrees. To the left he placed a black box in which was a frosted electric bulb of 5.5 cm. in diameter, whose light was directed into the eyes of the patient by reflection from the glass plate. This illuminated test object he calls *Spiegelmarke* (Mirrormark) and is adjusted to the center of the drum. Through a footswitch the examiner turns the light on and off at times unknown to the patient. In cases where the light intensity is too great he uses gray filters. We have now the optokinetic nystagmus created by the black and white stripes of the rotating drum, and the optostatic innervation of the *Spiegelmarke*. When the patient fixates and recognizes the *Spiegelmarke* we have immediately the breaking off of the nystagmus. The smaller the *Spiegelmarke* which leads to the breaking off, the better is the fixation ability, and from the size of the *Spiegelmarke* and its visual angle the visual acuity is determined. With the recognition of the smallest *Spiegelmarke* we deal with the *minimum visible* and not the *minimum separabile* as in the optotypes.

Ohm also uses a fixation object of 100 apertures of 0.4 millimeters each in diameter, placed in a square of about 5 degrees. If the eye of the patient wanders somewhat off the visual line, it will still be innervated by one of the other 100 apertures. While this fixation object as a whole is not easier to recognize than the single *Spiegelmarke*, it still has some advantage, as Ohm assumes a faster stoppage or breaking off is noticeable with the 100 aperture fixation object, since not only the image of the aperture is fixed centrally on the fovea but excentric areas outside the fovea are also stimulated.

To prove the malingering of some patients Ohm uses the following methods:

1. Surprise effect. While the drum is rotating the *Spiegelmarke* is suddenly projected.

2. Orientation effect. First we see the mark and then the drum is rotated.

3. Questionnaire effect. With the turning of the drum and the projection of the mark he questions the patient as to what he sees. As the patient answers that he notices the rotation of drum and a point of light, a breaking off sometimes ensues.

4. Attention effect. He tells the patient to watch everything he sees.

5. Order effect. He tells the patient to look at the point of light.

Ohm claims that through the varied use of this system, he detects any malingering. He further states that the determination of the visual acuity objectively as against subjectively is 2:1 in favor of the former.

Ohm went a step further, and that is the objective determination of refraction through the optokinetic nystagmus. He modifies the light intensity of the *Spiegelmarke* through the gray filters, places the lenses in the trial frame and observes the nystagmus. The closer he comes to the refractive state of the eyes the sharper and better is the breaking off point. This is true also in astigmatic cases, and can be effectively used in cataract cases and young children.

METHOD TO INDUCE OPTOKINETIC NYSTAGMUS AFTER GOLDMANN

Goldmann's method (1943), is not that of stoppage or breaking off but of the optokinetic eye pendulum. To bring this about he uses a test object in the form of a swinging plate which passes behind a cut out window. As soon as the patient sees the figure it appears to him to be swinging back and forth and results in an eye pendulum motion. The eye pendulum motion is very small and has to be observed by the examiner from the side through a magnifying head mirror. Visus 1 is present at an observation distance of 1.25 M.

GUENTHER'S METHOD

Guenther of the University of Berlin has also contributed much of value in this field. His book and apparatus date 1949 and 1950. He took an opposite position from that of Ohm. He reasoned that to get constant results we had to have test objects of known angular values and know the distances from the patient to the test object. His aim is to keep the field of innervation constant, as a change of the size of the field results in a change of the amplitude of the optokinetic nystagmus.

The principles of Guenther's methods resolve themselves into five factors.

1. Size of innervated field.

2. Innervating object.
3. Distance.
4. Speed of object moving through the visual angle.
5. The oscillation frequency.

In order to induce the optokinetic nystagmus by Guenther's method we have to have a test object in which we differentiate between the stimulated field and the stimulated objects.

The size of the innervated field is constant, being between two and three degrees, in contrast to that of Ohm's of 33 degrees horizontally. The constancy of the stimulated field at the various distances is assured by changeable diaphragms of 5, 10 and 15 cm. squares. Only in special cases, such as a central scotoma larger than 3 degrees, does Guenther use a larger innervated field up to 17 degrees. Even by a scotoma as large as 15 degrees the peripheral visual acuity can be easily determined with reasonable accuracy. Since the innervating field is so small it has its own character, and we deal with optokinetic nystagmus created by this small field, and since this brings about a very small amplitude, we need the magnification of a lupe to see the movements exactly. Guenther points out that theoretically we should not call the movements "nystagmus" anymore, and he referred to them as optokinetic eye movements. On these movements only the rapid phase can be recognized with accuracy.

The stimulating objects consist of black and white chessboard targets consisting of 10, 5 and 2 millimeter squares. Through a variation of the distances from 0.5 meter to 4.5 meters we receive visual angle values from 1.5 minutes to 60 minutes. With an optokinetic minimum of two minute angle we will have visual acuities ranging from as low as 0.03 to 1.3.

The speed of the object through the visual angle is given through the Cords formula:

$$\frac{\text{Velocity}}{\text{sec.}} = \frac{\text{Length of ribbon}}{\text{Rotation time} \times \text{viewing distance}}$$

In Guenther's instrument the length of the ribbon or band which runs over the two rating cylinders is 100 cm. The speed of rotation for the stimulated object is for 2 mm., 10 seconds. 5 mm., 7 seconds. 10 mm., 5 seconds. The oscillation frequency is derived from the number of oscillations per second passing the center of the innervated field.

$$\text{Hz} = \frac{\text{Visual angular speed (Cords Formula)}}{\text{Value of the angle}} \times \text{number of innervated objects}$$

His instrument consists of a black screen. In the center of the screen is a window holding the exchangeable diaphragm of 5, 10, and 15 cm. squares. In back of it are two cylinders of 9.5 cm. diameters over which runs the 100 cm. ribbon with the black and white chessboard targets in 2, 5, and 10 millimeter diameter. The ribbon runs from right to left and two bulbs illuminate the field evenly 200 lux. In front of the screen is a chin rest with a fixation tube of 20 cm. in length and 4 cm. in diameter, which can be adjusted for each eye separately. The tube when adjusted correctly will throw an image of the light on the cornea. The image is rather small, and in order to see it, a 13 diopter lupe and a spotlight are necessary. The light of the spotlight is directed to the subject's temple near the eye which in turn forms on the edge of the cornea a strong reflex image, and with the rhythmic movement of this image, the optokinetic nystagmus is recognized.

The examination is made in a semi-darkened room, and the patient has to be dark adapted for from 5 to 10 minutes to adapt himself to the prevailing illumination. There is no light in the room except that of the instrument. The examination is monocular, the non-fixing eye is occluded with a black shield.

Guenther starts with values below the threshold and increases them gradually, or he starts with the medium values and increases or decreases them, or he starts with values above the threshold and decreases them gradually. He has an assistant, and by the order of "one," the helper rotates the cylinder to the right; by "two" to the left, and "stop" brings it to a halt. The helper has to repeat the commands as the examiner has to devote all attention to the observation of the nystagmoid movements, and in this way knows in what direction to expect the jerks. Guenther also rotates the ribbon with the fixation object in both directions, right and left, as this is important for the better recognition of the nystagmus. If the oscillation is great, the examination distance is increased to a point where the nystagmus will still be seen in both directions. From the distance and the size of the test objects the visual acuity is determined.

In the determination of the size of the innervated field, Guenther found when the field is of 48 to 60 minutes, the reaction of nystagmus is clearly visible. He found in opposition to Ohm, nystagmoid movements in a much smaller field, although the field had to be observed with a magnifying glass. This is of importance in finding out what constitutes the optokinetic minimum. He found the subjectively noticed threshold for the black and white chessboard fixation object by innervation of a central retinal area to be 2 degrees.

To explain the threshold for the appearance of the nystagmoid movements Guenther called on Weymouth's[6] writings of the visual acuity in the foveal region. Weymouth proved that in the center of the fovea from 0 - 60 minutes a reduction in the visual acuity is noticeable. This is caused by the wandering of the test object from the fovea to a less sensitive part of the retina under a certain speed. As seen before, the smallest size of the innervated field to arouse optokinetic movements has to be 30 - 40 minutes. Due to this a stimulating object of a size of one minute might be noticed subjectively but to create the optokinetic reaction a two minutes object is needed.

At present the writer is making these tests, using a disc of 30 cm. in diameter, covered with black and white stripes of a width of 2 cm. each, and by moving the disc back and forth or up and down, synchronated movements occur connected with opposite jerks. The writer is planning to construct an apparatus along the lines of Guenther's, and hopes to continue this study.

Much work must still be done to make the observation of the optokinetic nystagmus easier and better. Perhaps more simplified instruments will be developed, but even though this method will never replace our conventional type of examination for the determination of the resolving power and the refraction of the eye, it has its place and should be given further attention.

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SUGGESTIONS FOR A NEW FEE STRUCTURE IN OPTOMETRY*

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PART V‡

In Part I of this report the writer mentioned a few of the factors which made the entire question of fees and charges for materials a timely one for consideration by all optometrists. It is generally agreed among optometrists that their present overall charge for services and materials is not excessive; and, also, it is agreed that many of the patients they serve seem to believe that the glasses they receive are high priced indeed! This paradoxical situation exists because the patient, in most instances, receives only one overall statement, sometimes called the unit-fee, and is unable to separate in his mind that portion of the overall fee which is for services and that portion which covers the costs of materials.

The present proposal for a new fee structure is designed to end this confusion. See outline on following page. That it will do this is assured by those who have experimented with the plan over a considerable period of time, and by those optometrists who have adopted the proposals since last July when they first appeared in print.

The writer believes that optometry, having reached full independence and stature as a profession, can no longer afford to conceal all or part of its professional service fees in the markup on materials. He further believes that this practice is illogical and unnecessary, and when done in a professional environment is no longer sound economics.

In addition, a number of national and international forces are at work, any one of which, if developed or extended much beyond their present aspects, would have far reaching effects upon optometry and the way we would be able to practice. To put this in another way, the economic and sociological climate in which we practice may be materially altered by the action of one or more of these forces.

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‡This is the concluding portion of this report. Part I appeared in the July issue, Part II in the August issue, Part III in the September issue and Part IV in the October issue.

As a professional group, we must have our affairs in such shape that we can withstand even the most serious economic and sociological upheavals. These may come. In optometry much fine work in this direction has already been done. From a legislative standpoint our house is in rather good order. Our schools and colleges are doing an admittedly good job. They will receive full recognition as healing arts educational centers as soon as they all go on a six-year basis. A schedule calling for two years of pre-optometric work and four years of undergraduate training.* In general, optometrists are accorded professional recognition by the public and by sister professions. Optometry has made marked strides in correcting the commercial aspects of the past, and now generally presents to the public the proper professional environment in which eye work should be done. The optometrist of today has sufficient undergraduate and graduate training to enable him to do his work skillfully and with pride. And, he has that pride in his work required of a skillful practitioner.

The remaining weakness is the confusion over fees. Optometrists, in the judgment of many, have failed to make it clear that, necessarily, a substantial portion of their one overall charge for services and materials *is* a professional fee. Too many of our patients still believe the glasses cost the total amount collected.

Given sufficient time, we could, and no doubt would, overcome this last major problem. Springer† claims that normal evolutionary develop-

*All optometric schools and colleges are now on a five year program.
†Part III of this report, September issue, 1952.

OUTLINE OF SUGGESTED FEE STRUCTURE

The author has proposed a simplified fee system for optometrists in professional practice. A minimum examination and refraction fee of $10.00 or more is proposed. In cases requiring specialized or unusual care, fees larger than the minimum are suggested.

A minimum dispensing fee of $5.00 for each pair of glasses dispensed is also suggested.

It is further suggested that all ophthalmic materials be dispensed to the patient at the prescription laboratory cost.

It is further suggested that the patient be presented with an individual itemized statement for professional fees, i.e., examination and refraction fee, minimum of $10.00 or more; plus dispensing fee of $5.00, if materials are dispensed.

In addition, it is suggested that all laboratory materials be collected for in full at the time the material is ordered, as this material is being dispensed to the patient at cost, and the optometrist should not, and cannot, carry any of these costs or charges on his open accounts.

The reader is referred to Part I of this report for the details of this proposal. (July, 1952, issue.)

ment would probably correct the situation—but—as he admits—perhaps time is running out on us. If that is the case, the present report on fees with its suggestions as to correcting the situation is timely indeed.

What are these pressures which may break with full impact upon us at any time? What influences are at work which may directly or indirectly affect our future? Are they important and can they upset the well planned future of optometry? The writer believes we can overcome them, but he also believes we can do so more readily and with less effort if we are prepared and have made the remaining necessary changes in our practices before the issues become critical. That is why the suggestions regarding a new fee structure are timely, presented, as they are, before the full impact of any of the following is felt by us as a professional group. It is timely, too, that we adopt in full, or in great part, the new proposals. In so doing we place our practices and our profession in a less vulnerable position than they are today. We become stronger professionally and better able to meet any conditions which the following major factors may bring.

INFLATION

Since 1938 when the first impact of World War II was felt in the economic and financial fields, we have been in an era of rising costs and prices. The B. L. S. old series Consumers Price Index is at 192.4 as this is written in August, 1952. This is based on exhaustive studies of prices, comparing today's costs with those of 1938. These figures include all cost of living items as these affect the individual optometrist in practice. They indicate that the things the optometrist must buy today cost nearly twice as much as the same things cost in 1938. Or, they indicate that today's dollar buys just one-half as much as the 1938 dollar. These are significant figures in a report dealing with fees.

Unless today's optometrists are receiving fees equal to twice those of 1938 they are not as well compensated today as they were in 1938 for doing the same work. In addition there is no assurance that this current inflationary cycle is at an end. It may continue with only minor increases, or it may get completely out of hand. Few, if any, economists believe the trend will be reversed in the next several years.

If optometry is to abandon the one overall fee and adopt a straightforward, fully understandable fee system, plus charges for materials, the time to do it is now. Employment is at a high level. The national income is at its peak. An adjustment in fees for optometrists can be made more easily in times of plentiful dollars than in times of depression.

In addition, a fee system in which nothing is hidden is defensible

and permits understandable readjustments if the inflationary cycle becomes worse.

AN ALL OUT WAR

Total war will bring back all the World War II controls with many new ones added. In addition it will bring about a manpower shortage which may well lead to a conscription of labor. If this should develop, a regimented public health program is sure to follow. Optometry will be part of this health program. Its fee structure should now be made clear to all, so that we can be assured of receiving proper compensation for our refractive work if an emergency of this kind arises.

THE MEDICALLY INDIGENT AND THE INDIGENT

In the immediate years to come, the low income groups (medically indigent) and the dependents (the indigent) are certain to be offered private and/or semi-public health plans which will be established on a very large scale. The present program of the Veterans Administration is one example. As these plans will eventually include widespread refractive health care, optometry must be ready to do its part in a professional manner. We can get ready for this by now clarifying our fee structure in the manner suggested. The fees secured by optometrists through these health plans will depend, to a large extent, on the *admitted fees* received by optometrists before the plans are put into effect.

INSTITUTIONAL AND INDUSTRIAL PROGRAMS

Industrial safety and health programs and Institutional Union health programs are today familiar to all optometrists. As long as industry is prosperous, and as long as the Union treasuries are in sufficient funds, these programs will continue and we, as optometrists, will find them growing in size. These programs present a real challenge to our leadership as when we participate in these, which we will do in time, the most we can expect is a proper fee for examining and refracting plus a dispensing fee if we are permitted to do the dispensing. Again a satisfactory and clear cut prior fee structure is essential.

COMMERCIAL OPTOMETRY PRACTICES

These practices continue although their number is becoming fewer yearly. They largely exist in the urban centers where they rely on a large and not too well informed public for their patients. Organized optometry is doing everything in its power to professionalize this group of optometrists and to get them to change their practices to conform with the code of practice of the A. O. A. The proposed suggested fee structure, if broadly adopted with success by optometrists now in professional practice, will encourage the remaining commercial practitioners

to adjust their practices to conform at least with the minimum standards of professional practice.

THE NEW FAIR TRADE LAW

On Monday, July 14, 1952, President Truman signed a controversal act permitting price fixing on trade marked and brand named merchandise. The law, called a "fair-trade" law, permits distributors and merchants within a state to agree on a fixed selling price for the item under consid·ion. Merchants who refuse to sign the agreement must nevertheless abide by this price, fixed under the law, *if they sell the item*. The legislation stirred up stormy debates in Congress, where it had been for some time before passage.

Under this new law the dispensing price of certain brand name ophthalmic frames and lenses could be fixed and anyone prescribing the particular materials would have to charge their patients the exact price which some wholesaler had agreed upon in collaboration with any one individual optician, optometrist or ophthalmologist in that state. Only one such agreement has to be signed and it becomes binding on all persons in the state.

George P. Haas, President of the Optical Wholesalers National Association, referred to this legislation in his annual address in Atlantic City in May of this year.* Haas indicated that the Factory Relations Committee of his association favored the legislation, and were working with certain manufacturers to secure its widespread adoption in the field of ophthalmic optics.

This writer opposes this action as being detrimental to the best interests of optometry and the millions of ocular patients in this country. He opposes the principle of price fixing on lenses and frames for several additional reasons. First, these items are not merchandise. Next, these materials are prescribed by optometrists and are not sold. Third, price fixing would give commercial optometrists and retail optical dispensers a high mark-up on these materials to enable them to further exploit the public. And last, if optometrists in professional practice used these fair-traded items they would be obliged to charge their patients prices for materials which had been set by representatives of groups whose attitudes in serving the public are incompatible with those of professional optometry.

In the writer's judgment optometry must use every effort to thwart the proposed program of price fixing on lenses and frames. Certain manufacturers are now giving this matter serious attention, and

*George P. Haas. Let's Help Us Help Ourselves. The Optical Index. 27.9.15-16. 1952

should the program be placed into effect the cause of professional practice in optometry will be retarded. Under the Fair-Trade law we would automatically be classed with merchants and our patients will be forced to pay the highest possible charges for fair-traded materials if these are used, thus curtailing the total number of refractions made each year. If those forces who wish to use this legislation to fix prices on ophthalmic materials are successful, optometrists have but one choice and that is to ignore those frames and lenses that have been "fair-traded" and prescribe other similar products that have not been subjected to these price fixing schedules.

DEPARTMENT OF JUSTICE—"KICK-BACK" INQUIRY

Following the court orders to those opticians and ophthalmologists involved in the "kick-back" investigation, the U. S. Department of Justice and the Federal Court expected the consumer price of glasses to drop in an amount more or less equal to the amount of the "kick-back." In some opticians' shops this occurred, but in many there was some doubt. In these latter shops the public did not benefit by the court action and the question naturally arose as to what disposition was made of this portion of the total selling price of glasses. The U. S. Department of Justice is now making an exhaustive study of the entire matter. It is definitely interested in the costs of ophthalmic materials supplied to the public. This inquiry cannot, of course, stop with the optician. Optometrists, too, must consider the matter of material costs to their patients as any future action, if taken by the Department of Justice, will rather logically affect all segments of those now in the eye care fields. Again, a forthright position on fees is essential in optometry's best interest.

HEALTH REGIMENTATION — C. H. I.

The selection of Eisenhower and Stevenson as candidates* for the presidency has lulled many individuals into a false feeling of security regarding Compulsory Health Insurance. Both candidates now seem so conservative, these individuals believe, that there is no possibility of Compulsory Health Insurance being enacted by the Congress during the next four years. Much of this seems true today and we hope their predictions are correct: yet, we as optometrists must realize that there are large blocks of voters and many politicians in both parties who would and will do everything in their power to advance socialized medicine under the fair deal trade mark of Compulsory Health Insurance.

This problem must be watched carefully, and as optometrists, we

*Written in mid-August, 1952.

must be prepared for any eventuality should it come. It must be remembered that no federal program of compulsory health insurance would permit optometrists to conceal all, or part, of their professional fees in the mark-up on materials. In fact, should this program materialize, the fees paid us for examining and refracting, under the program, would, in large part, depend on the openly collected examination and refractive fees optometrists were receiving before the program started. This was true in Great Britain, where they now have a similar program, and will probably be so here. Certainly adequate and forthright fees will be a necessity under compulsory health insurance should it become a reality. The time to set the precedents for these fees is now.

DEPRESSION OR RECESSION

While no severe depression or recession seems imminent, it must also be admitted that should such a protracted period of unemployment develop, for any reason, it would give a tremendous surge to the already present demand for socialized medicine or compulsory health insurance. Again, the writer points out that our fee structure should now be properly established and understood by all, while we are still in good times. It would be much more difficult to make this change in a period of widespread unemployment.

CONCLUSION AND SUMMARY

The writer has presented suggestions for a new fee structure in optometry. The proposed plan eliminates the present practice of hiding or confusing part of the optometrist's fees in the markup on materials. The proposed plan, when adopted, places a premium on the optometrist's skill as a visual specialist. The optometrist's income will consist of professional fees only and his work will further improve because of his added pride in his specialty. In addition, his standing as a professional man in his community will be enhanced. Within reason, better professional fees have a way of bringing higher professional regard. Under the program, as suggested, materials take their proper place in our work, and we can better control their quality and their use. We also remove the criticism (just or not) of profiting when these materials are prescribed. To a very large degree only merchants and trades people profit on the sale of materials.

The plan as suggested can easily be adopted by any optometrist in professional practice. The plan may be modified to fit the optometrist's individual needs. The essential factors are the separation of fees for services from the charges for materials. These must retain their individual entity, not only in the mind of the optometrist, but also in the understanding of the patient. In addition, the professional fee

charged the patient must be the *total* fee. Nothing must be concealed.

In Parts II*, III and IV various aspects of these suggestions were reviewed. Questions regarding the proposal were answered and comments and suggestions made regarding the plan were discussed.

In Part V of this report the writer has presented some of the more timely pressures already being felt upon optometry and also mentioned others whose effects may be felt in the future. These were presented because the writer believes we must be ready to face any eventuality. A part of our program of readiness consists of eliminating the present doubt and confusion which exists around the fee question. The suggestions for a new fee structure in optometry eliminate this problem when the proposals are put into practice.

*Part I appeared in the July, 1952, issue. Part II in the August issue. Part III in the September issue. Part IV in the October issue. Back issues are available at the offices of the publication.

ABSTRACT

THE EFFECT OF CORRECTIVE LENSES FITTED AT WORKING DISTANCE UPON THE PRODUCTIVE EFFICIENCY OF HOSIERY LOOPERS. Dannie J. Moffie, Howard C. Olson and Clinton L. China. North Carolina State Optometric Society Research in Vision Project, Dept. of Psychology, N. C. State College, Raleigh, N. C., pp. 20-27, 1952.

The major purpose of this research was to determine the effect of corrective lenses fitted at working distance upon the productive efficiency of hosiery loopers. The subjects were two groups of 20 women hosiery loopers equated according to production, gauge of looping machine and consistency of production.

In Phase I of the experiment, the experimental group only wore corrective lenses for a period of 20 weeks. In Phase II of the experiment, both groups wore corrective lenses for a period of 20 weeks. Production data were obtained for these periods as well as for a 20-week period prior to the beginning of the study.

The authors concluded that the wearing of corrective glasses tends to result in a slight increase in looper production, but the gains were not significantly different from chance gains. The loopers and their employer expressed pleasure and satisfaction with the program of fitting corrective glasses. It is believed that the corrective lenses fitted for the looping task reduced eye discomfort, headaches and the rate of absenteeism.

ROBERT E. BANNON.

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WHERE ARE THE OPTOMETRIC STUDENTS?*

The recent low enrollment figures of our schools and colleges of optometry, when officially released, will evoke some anxious thoughts in the minds of all conscientious practitioners. Why do we fail to attract more students to this field which at once is broadening its horizons and yet narrowing its ranks? This year, we have not accepted enough students to replenish the numbers of optometrists who leave the profession through retirement or death. Our schools are faced with serious problems. Paradoxically, there seems to be a very real interest among some groups of optometrists to create *new* schools, but not a

*By Richard Feinberg, Ph.D., D.O.S. President, Northern Illinois College of Optometry. Fellow, American Academy of Optometry.

great deal of energy has been expended in the support of our existing institutions of learning. It is time that we take stock of our academic situation.

Various reasons may be projected for the limited number of applicants to our profession. The heightened cost of education and the draft are the two most reasonable excuses usually forwarded. The fact that few optometrists are recommending young men and women to this profession is not usually advanced as a reason. Yet, it is perhaps the most significant. If it were resolved, the present circumstances easily could be rectified. Another is the closure of certain states to graduates other than those from a selected small number of schools. Despite the fact that the Council on Education of the American Optometric Association has rigid rules by which it examines and accredits the schools and colleges of optometry, some states do not recognize the Council's accreditation as valid. This restricts applicants from seeking entrance into some schools and in several instances has turned them to other vocations.

Another inescapable conclusion is that many of our practitioners have a devalued concept of their chosen field, and failing to recognize its potentialities and challenge, surrender themselves to a mediocre pursuit of its more mundane aspects. This scarcely acts in a positive direction in inviting desirable condidates to this profession.

Our schools, loosely knit through an association of schools and colleges of optometry, face these issues with forebearance or resignation.

The lack of support of our existing schools by their respective alumni is a matter to contemplate. It will be granted that our profession has had its growing pains and that our educational institutions have not been unaffected. Creating more schools and not providing support to our existing schools lacks all semblance of sanity. The fever is catching, and there is much talk in the wind for still more schools. Where the students are to come from to populate these is not so frequently discussed.

It behooves every member of the American Academy of Optometry to regard these problems as his own. Ultimately, his profession will stand or fall by the fate of our schools and colleges of optometry. Support your houses of learning. Give them loyalty. Devote your energies to the maintenance and development of our present schools. Respect your profession and yourselves. Organize and be active in your Alumni Associations. Recommend this fine vocation to other young men and women. Then, and only then, will our schools and our profession survive.

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CHICAGO, ILLINOIS.

RICHARD FEINBERG

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

PROGRAM FOR ACADEMY MEETING

DECEMBER 6, 7, 8, 9, 1952
ROCHESTER, NEW YORK

From all indications, Academy members can look forward to four exceptionally stimulating and enjoyable days at Rochester, New York, at the annual meeting of the American Academy of Optometry. The Papers and Program Committee, under the direction of Dr. Meredith W. Morgan, Jr., has prepared a program with appeal for all: 29 papers whose subjects reflect the broadened interests of optometrists, and which cover the latest scientific developments in optometry. Four of the 29 papers are of historical interest—Dr. Edwin F. Tait, Dr. Charles Sheard, Dr. Julius Neumueller and Dr. Glenn Fry will re-present papers given before at Academy meetings, and considered significant enough to repeat, with the addition of modern developments of their topics. Thirty of the program hours will be devoted to special section meetings on aniseikonia, contact lenses, pathology, occupational vision and orthoptics.

This year's special feature will be a guided tour through the bifocal plant of the Bausch & Lomb Optical Company, which will be celebrating its 100th anniversary next year. B & L will also entertain Academy members at a special luncheon Tuesday. The Academy is the first of several groups that will help B & L celebrate its founding; the others plan to be in Rochester in 1953. Interest is already high on the proposed tour through the Bausch & Lomb plant—it is a "once-in-a-life time" opportunity for Academy members.

In keeping with tradition, an annual roundtable banquet will be held on Monday evening. Dr. Harold Simmerman, Academy President, will be the guest speaker. Dress is formal.

A chapter luncheon will also be held, this year on Sunday. Here chapter representatives will have the opportunity to discuss mutual problems and report on local Academy progress.

Make your reservations now at the Hotel Seneca for December 6, 7, 8 and 9, 1952. (We hope you already have!) Bring your thinking cap, notebook and pencil, tux, and a backlog of sleep to Rochester so you can relax and enjoy an education-packed, stimulating four days of Fellowship.

VIRGINIA HUCK.

PROGRAM

SATURDAY, DECEMBER 6, 1952

9:00 Registration

10:00 Business Meeting

11:00 Visual Tasks in Aerial Mapping With Multiplex Equipment
K. Pestrecov, Sc. D., Department Head, Scientific Bureau, Bausch and Lomb Optical Company

11:30 Discussion†

11:40 Legalism in Ethics
Eugene Freeman, Ph.D., Dean, Chicago College of Optometry

12:10 Luncheon Recess

1:30 Directional Sensitivity of the Pupillomotor Photoreceptors
Mathew Alpern, Ph.D., and Donald J. Benson, College of Optometry, Pacific University

2:00 The Role of Certain Visual Phenomena in Adolescent Personality Adjustment
Charles S. Bentley, Jr., M.Sc., and Donald A. Springer, O.D. Department of Psychology, Alabama Polytechnic Institute

2:40 An Analysis of Four Visual Screening Tests at Grades Four and Seven
Helen M. Robinson, A.M., Ph.D., Director, Reading Clinic and Associate Professor of Education, University of Chicago

3:20 The Genesis of Myopia—A Working Hypothesis
Monroe J. Hirsch, Ph.D. Professor of Optometry, Los Angeles College of Optometry

4:00 The Contribution of Contact Lens Technique to Optometry
Frank Dickinson, F.B.O.A. (Hons.), F.O.A. (SA) F.A.A.O. St. Annes-on-Sea, Lancashire, England

4:35 Summation Effects with Contact Lenses
Isidore Finkelstein, Ph.D. School of Optometry, Columbia University

5:15 Dinner Recess

7:45 The RDP and Its Application
Gordon L. Walls, Sc.D., Professor of Physiological Optics and Optometry, University of California

†A 10-minute discussion period follows each paper.

8:25 The Effect of Stimulus Size and Retinal Illuminance on the Human Electroretinogram
Elwin Marg, Ph.D., Lt. Col., USAF
Aero Medical Laboratory, Wright-Patterson Air Force Base

8:55 Visual Recognition
Carl Shepard, O.D., D.O.S., Chairman, Committee on Standards, A.O.A., Northern Illinois College of Optometry

SUNDAY, DECEMBER 7, 1952

9:00 Section Meetings
Aniseikonia
Contact Lenses
Occupational Vision
Orthoptics
Pathology

11:00 An Investigation of the Effect of Auditory Flicker on the Perception of Visual Flicker
George W. Knox, Ph.D., Assistant Professor of Optometry, Ohio State University

11:35 An Infra-Red Skiascope and Other Infra-Red Ophthalmic Instruments
Henry A. Knoll, Ph.D., Los Angeles College of Optometry

12:05 Chapter Luncheon

2:15 The Method of Concordance in the Diagnosis of Strabismus
Joseph I. Pascal, M.A., O.D., M.D., Director of Eye Department, Stuyvescent Polyclinic; Lecturer, N. Y. Polyclinic Medical School

2:55 An Investigation of the Time Characteristics of Accommodation and Convergence of the Eyes
Merrill J. Allen, Ph.D., School of Optometry, The Ohio State University

3:35 Velocity and Acceleration Patterns of Saccadic Eye Movements
Gerald Westheimer, School of Optometry, The Ohio State University

4:15 Some Aspects of Optometric Jurisprudence
Morton L. Abram, LL.B., D.O.S., President, Chicago College of Optometry

4:55 Space Eikonometry in Aniseikonia
Robert E. Bannon, O.D., D.O.S., Bureau of Visual Science, American Optical Company, Southbridge, Massachusetts

5:35 Dinner Recess

* 7:45 A Quantitative System of Dynamic Skiametry
Edwin F. Tait, M.D., Ph.D., Associate Professor of Ophthalmology, Temple University School of Medicine

* 8:35 Zones of Ocular Comfort
Charles Sheard, Sc.D., Dean, Los Angeles College of Optometry

MONDAY, DECEMBER 8, 1952

9:00 Section Meetings

11:00 An Investigation of the Factors Affecting the Fields of Fixation Through Multifocal Lenses
Kenneth Zinnecker, M.Sc., Columbus, Ohio, and Vincent Ellerbrock, Ph.D., Ohio State University

11:40 The Specification of Color of Ophthalmic Glasses
Wilson Sterling, Department of Ophthalmic Research and Development, Bausch and Lomb Optical Company.

12:30 Luncheon Recess

2:00 The Measurement of Marginal Astigmatism in Ophthalmic Lenses
Henry A. Knoll, Ph.D., Los Angeles College of Optometry

2:30 The Luneberg Distortion of Vieth-Mueller Circles
Ivan Epstein, M.S., Scientific Bureau
Bausch and Lomb Optical Company.

3:10 The Variation of Proximal Convergence With Change in Distance
Max Schapero, O.D., and Morton S. Levy,
Los Angeles College of Optometry

* 3:50 Optical, Physiological and Perceptual Factors Influencing the Ophthalmometric Findings
Julius Neumueller, O.D., Pennsylvania State College of Optometry

4:30 Business Meeting

6:00 Refreshments

*Invited Historical Paper.

7:00 Annual Roundtable Dinner (formal)
Speaker: Brian O'Brien, Ph.D., Director, Institute of Optics, University of Rochester, Rochester, N. Y.
Topic: Vision and Resolution in the Central Retina

TUESDAY, DECEMBER 9, 1952

9:00 Section Meetings

*11:00 Program of Research in Accommodation and Convergence at the O. S. U. School of Optometry
Glenn Fry, Ph.D., Director, School of Optometry, Ohio State University

11:50 Incidence of "Clearing" in Normal Subjects Made Artificially Myopic
Ernest J. Giglio, A.B., School of Optometry, Columbia University

12:45 Bausch and Lomb Optical Company Luncheon

2:00 Visitation to Bausch and Lomb Optical Company

In addition to the above papers, each of our sections has arranged its own six hour program to cover their individual allotted periods during the meeting. The detailed program for each of the sections will be distributed at Rochester. The section programs were prepared under the direction of the following section chairmen:

Aniseikonia—Leo F. Madigan, O.D., Boston, Massachusetts
Contact Lenses—John C. Neill, O.D., Pennsylvania State College of Optometry
Occupational Vision—Richard Feinberg, Ph.D., President, Northern Illinois College of Optometry
Orthoptics—J. Donald Kratz, O.D., Pennsylvania State College of Optometry
Pathology—William O. Vivian, O.D., Media, Pennsylvania.

NEW MEMBERS OF THE ACADEMY

The following optometrists were elected to Fellowship in the American Academy of Optometry during October, 1952. The Academy welcomes these new members.

Dr. C. Henry Chevalier, Director, Optometrical Department, American Optical Company, Southbridge, Massachusetts.

Dr. Gordon E. Lewis, 411 Security Building, Pasadena, California.

Dr. Arthur E. Tillisch, 615 W. Lake Street, Minneapolis, Minnesota.

*Invited Historical Paper

CURRENT COMMENTS

Virginia Huck
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department: such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

MILITARY GROUP TO MEET IN ROCHESTER

The annual meeting of the Association of Military Optometrists of the United States will be held Sunday, December 7, at the Hotel Seneca, Rochester, New York, according to Dr. D. R. Reed, Association Secretary. This group was formed several years ago to further the interests of optometrists serving in the armed services. This meeting will be held concurrently with the annual convention of the American Academy of Optometry.

A. O. A. BOARD OF TRUSTEES TO MEET IN ROCHESTER

The interim meeting of the American Optometric Association Board of Trustees will be held in Rochester, New York, just prior to the annual meeting of the American Academy of Optometry.

O. M. A. REGULATION

The Optical Manufacturers Association announces it has gone on record opposing the following practices in connection with ophthalmic functions: Giving prizes at golf tournaments and other social and business affairs. The advance sale of lottery or raffle tickets. Giving souvenirs, and gifts of value, including samples of merchandise at optical conventions. Advertising in souvenir programs.

The Association further announces that its members are opposed to making cash contributions to ophthalmic organizations, except as they are considered and endorsed by the Optical Manufacturers Association. Payment for registration fees, exhibit space and sustainer fees at conventions, without due representation, shall be construed as a cash contribution.

The above announcement is made at the request of the Optical Manufacturers Association in a notice to ophthalmic editors.

NEW YORK FIRM OFFERS AID IN LOCATING RARE BOOKS

Occasionally the Journal receives requests on where to locate certain books that are out of print, and consequently hard to find. One source recently brought to our attention is the American Library Service, 117 West 48th Street, New York 26, New York, which specializes in books out of print on all subjects and in all languages. We suggest you write them if you cannot locate a book you need for your library.

NEW DEVELOPMENTS AT BAUSCH & LOMB

An all-plastic eye shield weighing 1¼ ounces for protection in semi-hazardous operations has recently been developed by Bausch & Lomb Optical Company, Rochester, New York. The shield has a flexible, one-piece curved acetate lens which can be replaced by bending or snapping it in or out of place. It can be worn over regular or corrective safety glasses. Named BAL-spec, the shield can be obtained in crystal clear or green acetate for glare protection.

Also newly developed at B & L is a wide-angle aerial camera lens that covers a field of more than 90 degrees. The camera lens, called Cartogon, has been produced for the United States Air Force, and was co-designed by Dr. Konstantin Pestrecov, chief photographic lens designer, Olin W. Boughton, director of the mechanical development, Charles J. DeGrave, James W. Shean, Allen E. Murray, and Ruth Lammerzahl. The lens "opens new possibilities in aerial mapping," according to its designers. "It is practically distortion free and capable of much finer image detail than possible with former wide-angle lenses," they claim. Dr. Pestrevoc will be one of the speakers at the coming annual Academy meeting in Rochester in December.

A. O. A. ANNUAL ROUNDTABLE ON PUBLIC RELATIONS

Every phase of a good public relations program will be covered in workshops at the coming annual A. O. A. roundtable on public relations, November 23, 24, 1952, at the Hotel Roosevelt, Pittsburgh, Pennsylvania. Radio, newspaper, magazine, and television techniques will be discussed, as well as policy problems in public relations. Public relations in the office, public opinion, audio and visual aids will be covered by guest speakers and members of the A. O. A. public relations staff. Featured speakers this year are Liam O'Connor, journalist; Dr. James F. Wahl, president, A. O. A.; Harold Bailey, managing director, A. O. A.; Dr. H. Ward Ewalt, Jr., Pittsburgh; Dr. Joe M. Ashmore, executive secretary, South Carolina Optometric Association; John C. Patterson, department of public information of the A. O. A., and Dr. Andrew F. Fischer, executive secretary, New Jersey Optometric Association. The entire program is under the direction of Dr. Elmer M. Soles, director, A. O. A. department of public information, who will also speak at the roundtable.

NATIONAL MAGAZINES FEATURE EYE CARE STORIES

Want to know what your patients are reading in national magazines about eye care these days? Get a copy of *Redbook*, *Woman's Home Companion* for November. *Redbook* carries an article, "There's a Racket in Eyeglasses," by Jhan Robbins, who spent several weeks in-

vestigating eye care practices in five cities, and interviewed several optometrists who attended the A. O. A. Congress in Miami Beach. The November issue of *Woman's Home Companion* features a picture story of a four-year-old getting glasses for the first time. "Penny Learns to Like Glasses," was written by the psychology editor of the magazine's staff, who prepared the story around the idea, "it's a better world when you can see it."

C. C. O. OFFERS COURSE FOR OPTOMETRIC OFFICE ASSISTANTS

A course designed to professionally train office assistants for optometrists has been inaugurated at Chicago College of Optometry. Thirty-five women have enrolled for the first session which will cover such subjects as the functions of the eye, visual training, ethics of optometry, duties of a receptionist, office arrangement and decoration, accounts and record keeping, and lay information about the common diseases of the eye. Staff members of the college and outside guest speakers will lecture. The Dames Club, composed of wives of undergraduates, is sponsoring the special short course.

NEWS BRIEFS

The National Board of Examiners in Optometry announces that 109 students successfully passed Part I of the annual examination given last June at the colleges. The next examinations will include Parts I, II, and III and will be given at the close of the 1952-53 school year. The Board meets in Chicago in December, at which time exact examination dates will be announced. . . . . Better Vision Institute will add an inexpensive series of educational "spots" for television to its annual campaign for better visual care. The spot announcements, accompanied by dramatic drawings, will tell of the "intricate wonders of the eye and how we see, the story of illusions, and the cosmetic features of glasses," announces President M. J. Julian. . . . . Southern College of Optometry conferred 25 Doctor of Optometry degrees at its Fall graduation. Of the 25 graduates, 13 were also awarded the Bachelor of Science degree. . . . . Three graduate students in physiological optics at the University of California were awarded fellowships by the American Optometric Foundation. They are Los Angeles College of Optometry graduates Darrell B. Carter and Gordon G. Heath, and University of California, School of Optometry graduate, Merton C. Flom. . . . . The portrait of Dean Emeritus, Ralph S. Minor, of the University of California will be unveiled on November 23 during the University's School of Optometry Alumni Reunion. Kenneth Stoddard, Dean of the School of Optometry, will make the dedicatory address. . . . . The Los Angeles College of Optometry Alumni Association held a reunion banquet on November 9. . . . According to the public rela-

tions department of Bausch & Lomb Optical Company, more than six million Americans have been ortho-rated in the nine years its industrial vision program has been in operation. On the basis of these tests, some 2,460,000 people have been urged to get professional eye care. . . . . The British are discussing Editor Koch's current articles on fee structures. The October 10, 1952, issue of the *Optician* reviews the first three parts of the article and brings up several points the British editor thinks worth considering. He invites comments among British optometrists on such questions as whether Koch's plan will bring about greater respect for optometry, whether the fee structure proposed will "remove the stigma now associated with selling glasses." etc. . . . . Canadians, too, are talking about the plan. The last issue of the *Canadian Journal of Optometry* reviews parts I, II, and III of Koch's article. . . . . Russell L. Stimson, of Los Angeles, was elected president of the American Board of Opticianry to succeed Leslie W. Myers, of Minneapolis, at the recent annual meeting in Chicago. Dr. Charles Sheard was elected secretary-treasurer. Philip E. Dempsey, Toledo, Ohio, vice president. . . . . Dale T. Newland, Jr., Iola, Kansas, was awarded N. I. C. O.'s first Tuitional Fellowship. Newland, Class of 1955, will receive full tuition every year. The award was based on the excellence of Newland's essay, "The Contributions of Optometry to My Community," character, leadership, personal recommendation and scholastic achievement. . . . . Shuron has added a new frame for men to its Browline family, named Ronsir. . . . . The Therminon Lens Corporation, Des Moines, Iowa, has become the midwestern factory representative of the Duroloid Optical Company, Providence, Rhode Island. . . . . Deadline for applications for admission to Pacific University College of Optometry's February, 1953, class is December 1, 1952. This is the class which will be starting its professional studies at the third year level. Applications for admission to pre-optometry classes will be accepted through January 15, 1953. . . . . Beta Chapter of Gamma Omega Phi recently sponsored a talk by Dr. Helen Robinson, Head of the Reading Clinic, University of Chicago, as part of its educational program. . . . . Plans for the first long discussed "Optical Fair" are under way for 1954 at the Palmer House, Chicago. The month of June has been tentatively picked as the date the optical groups will get together to discuss mutual problems and put on their exhibits. . . . . Univis Lens Company announces a new vocational CV lens to meet the special requirements of presbyopes who "must carry out prolonged seeing tasks within the nearer portion of the intermediate range of vision." . . . . The Woman's Auxiliary of the A. O. A. have taken on the distribution of the new A. O. A. visual recognition charts as well as the sale of visual care stamps.

AMERICAN ACADEMY OF OPTOMETRY

GEOGRAPHICAL DIRECTORY OF MEMBERS

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b. Do your eyes tire more quickly indoors?
c. Do TV or movies bother you?
d. Notice any discomfort symptoms before watching television?
e. Are your eyes light-sensitive in other ways?

2 IF GENERAL PURPOSE ABSORPTION IS INDICATED THE TCA IS HELPFUL

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b. Explain that you are making this additional test for light sensitivity
c. Ask patient, "Is this better (white lenses) — or this (Soft-Lite #1 or #2) — or this (Soft-Lite #2 or #3)"
d. These answers, plus other case history data, will indicate shade best suited.

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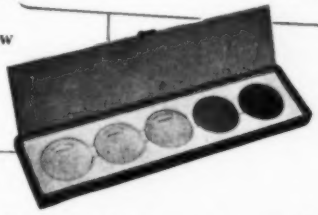

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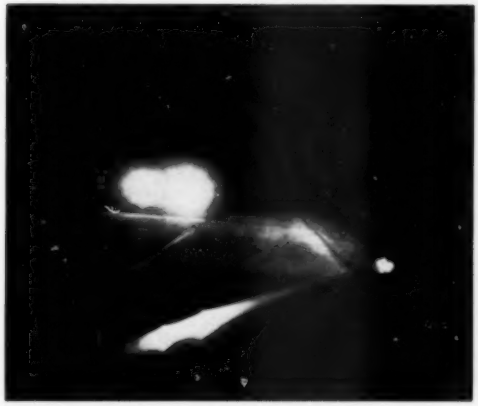

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